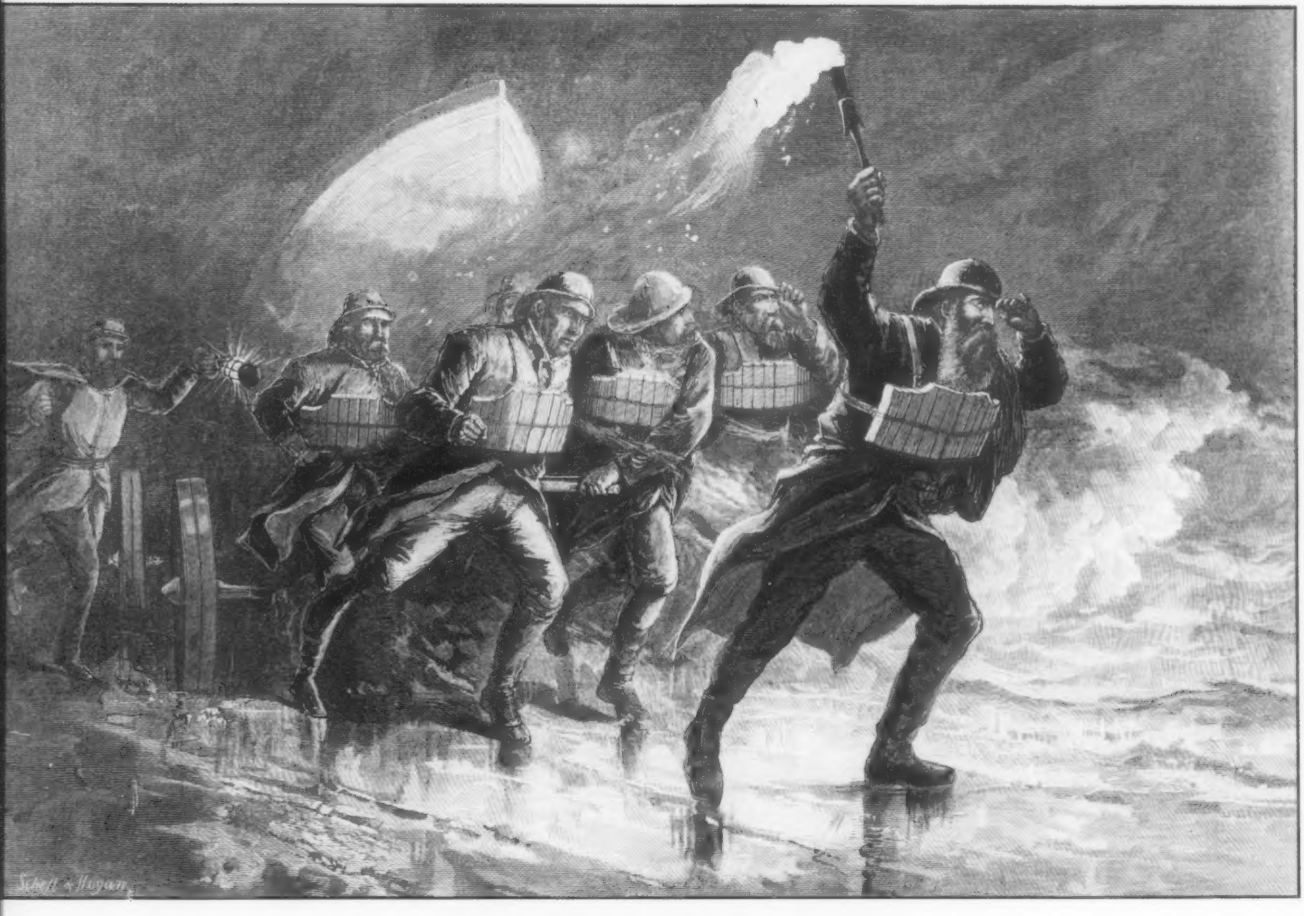
Mariners Weather Log

Vol. 42, No. 1 April 1998



"To The Rescue!"

Hurrying with a surf-boat to the scene of a wreck.

Harper's Weekly, May 19, 1877. Drawn by F. Cresson Schell and Hogan.
Courtesy of the Independence Seaport Museum, Philadelphia, Pennsylvania.
See article on the History of the U.S. Life Saving Service on page 51.

Mariners Weather Log

Editorial Supervisor
Martin S. Baron

Editor
Mary Ann Burke

U.S. Department of Commerce
William M. Daley, Secretary

National Oceanic and Atmospheric Administration
Dr. D. James Baker, Administrator

National Weather Service
John J. Kelly, Jr.,
Assistant Administrator for Weather Services

National Environmental Satellite, Data, and Information Service
Robert S. Winokur,
Assistant Administrator

United States Navy
Naval Meteorology and Oceanography Command
RADM Kenneth E. Barbor USN, Commander

The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this department. Use of funds for printing this periodical has been approved by the director of the Office of Management and Budget through December 1998.

The Mariners Weather Log (ISSN: 0025-3367) is published by the National Weather Service, Office of Meteorology, Integrated Hydrometeorological Services Core, Silver Spring, Maryland. (301) 713-1677, Ext. 134. Funding is provided by the National Weather Service, National Environmental Satellite, Data, and Information Service, and the United States Navy. Data is provided by the National Climatic Data Center.

Articles, photographs, and letters should be sent to:

Mr. Martin S. Baron, Editorial Supervisor
Mariners Weather Log
National Weather Service, NOAA
1325 East-West Highway, Room 14108
Silver Spring, MD 20910

Phone: (301) 713-1677 Ext. 134
Fax: (301) 713-1598
E-mail: martin.baron@noaa.gov

Table of Contents

Departments:

From the Editorial Supervisor

With this issue of the Mariners Weather Log (MWL), we begin implementation of a new trimester production schedule, replacing the quarterly schedule followed since the early 1980s. We'll be publishing the Log three times yearly—in April, August, and December of each year. For paid subscribers, there will be a reduction in the subscription fee from $16.00 to $9.50 per year. Please see the updated subscription form on the inside back cover.

The MWL has a circulation of 8,100 copies distributed to mariners, marine institutions and the shipping industry, scientists and enthusiasts, educational and research facilities, educators, libraries, government agencies and offices worldwide. In the August 1998 issue, we are planning to include a questionnaire to update our mailing list and MWL articles. Your cooperation in filling these out and returning them will be greatly appreciated.

I have received many inquiries about former MWL Editor Dick DeAngelis. Now retired, Dick and his wife Kirsten are living near the shore in Snow Hill, Maryland. They live in a three-story house built in 1880 which, appropriately, has been known as the "Captain's House" by area old-timers. Dick has been busy with home improvement projects, especially with flooring, and is looking forward to crabbing and fishing on Chincoteague Bay this summer. He's planning to purchase a canoe to explore the nearby Pocomoke River. Snow Hill was also the home of PMO Ray Brown for many years. Ray's wife Ann and four of their sons still live there; regretfully, Ray passed away two years ago.

Several readers have contacted me for information about large or freak waves. I usually refer them to the special Fall 1993 MWL wave issue, which had many excellent articles and photographs. In February 1977, I witnessed an exceptionally large freak wave. I was a science officer aboard a research/survey ship in the North Atlantic and had the good fortune (or bad, depending on your point of view) of being on the bridge just before Mayday. We were under Force 9 (strong gale) conditions when, to the shock of everyone on the bridge, a wave about 70 feet high, nearly three times higher than the sea waves, suddenly appeared 10° to starboard. The wave crest was preceded by an exceptionally deep wave trough. Seconds later, the giant wave crashed into the bridge. The vessel took a 30° roll, and everything not fastened down was thrown about in great disarray. Remarkably, not a drop of water came inside the bridge and no one was hurt (although several people asleep at the time reported being thrown out of bed).

If you have had experiences similar to mine or have photographs of unusual waves or freak waves, please share your information with us. Be as specific as you can with the dates, times, locations, and heights of the waves. We'll publish your accounts and photos in the Log.

This issue contains a follow-up article by Dr. Kousky on the El Niño. It seems that MWL readers have a special curiosity about the El Niño phenomenon, probably because it so clearly shows the connectivity between the ocean and atmosphere, and how this impacts weather. That conditions in the Equatorial Pacific Ocean (involving trade winds, cold water upwelling, and sea surface temperatures) can affect the weather thousands of miles away, at different latitudes, is indeed intriguing. As of this writing, the 1997/1998 El Niño is still conspicuous, but on the wane, with Eastern Equatorial Pacific temperature anomalies running 1-3°C above normal (they had been 3-5°C above normal). The variety of atypical weather events and phenomena associated with El Niño continues worldwide.

This has been the best observed El Niño ever, thanks to an array of 70 moored buoys deployed across the equatorial Pacific—the Tropical Ocean Global Atmosphere/ Tropical Atmosphere Ocean (TOGA/TAO) buoys, in operation since 1994. (See the Pacific Marine Environmental Laboratory home page at **www.pmel.noaa/gov/toga-tao/**.)

Martin S. Baron⚓

The 1997-98 Warm (El Niño) Episode in the Tropical Pacific: Development and Early Impacts

Vernon E. Kousky
Climate Prediction Center, NCEP/NWS/NOAA
Washington, D.C.

Introduction

Warm (El Niño) episode conditions rapidly developed in the tropical Pacific during the first half of 1997. During the summer and fall 1997 seasons (Northern Hemisphere seasons will be used throughout this paper) sea surface temperatures throughout the central and eastern equatorial Pacific reached record levels for that time of year. The anomalous sea surface temperature (SST) pattern was accompanied by major departures from normal in the distribution and intensity of convection and precipitation in the tropics, and by significant precipitation and temperature anomalies in some regions of the extratropics.

The Development and Impacts of the 1997-98 Warm Episode

The very large departures from normal of SST resulted from a highly anomalous seasonal cycle throughout the eastern tropical Pacific. Comparisons between the observed and climatological SSTs for key index regions are shown in Figure 2. Typically the eastern Pacific experiences a rather large seasonal cycle with maximum (minimum) temperatures occurring during March-April (September-October). During early 1997 SSTs increased more rapidly than normal in the Niño 3.4, Niño 3, and Niño 1+2, contributing to a reversal of the sign of the anomalies from negative to positive. SSTs continued to increase in the Niño 3.4 and Niño 3 regions until June. Thereafter, SSTs in these regions remained nearly constant or increased slightly through the end of the year. In the extreme eastern equatorial Pacific (Niño 1+2 region) the maximum and minimum in the observed SSTs occurred at the climatological times, but the seasonal decrease during spring and summer was only about half of normal. By the end of 1997 SSTs were greater than 28C in all of the index regions.

Consistent with SSTs near or above 28C, enhanced convection and rainfall persisted over the entire tropical eastern Pacific from spring through fall (Figure 3). Estimated rainfall amounts were up to 1000 mm greater than normal in some regions (Figure 4, middle). During the same period, suppressed convection (positive OLR anomalies) and drier than normal conditions dominated Indonesia, Malaysia, and the eastern Indian Ocean. Estimated rainfall deficits for this region ranged from 500 mm to more than 1000 mm in some sections (Figure 4, top).

The anomalous pattern of precipitation over Indonesia and the tropical Pacific also contributed to rainfall anomalies over South America and the western Indian Ocean/eastern Africa region. Drier

Continued on Page 7

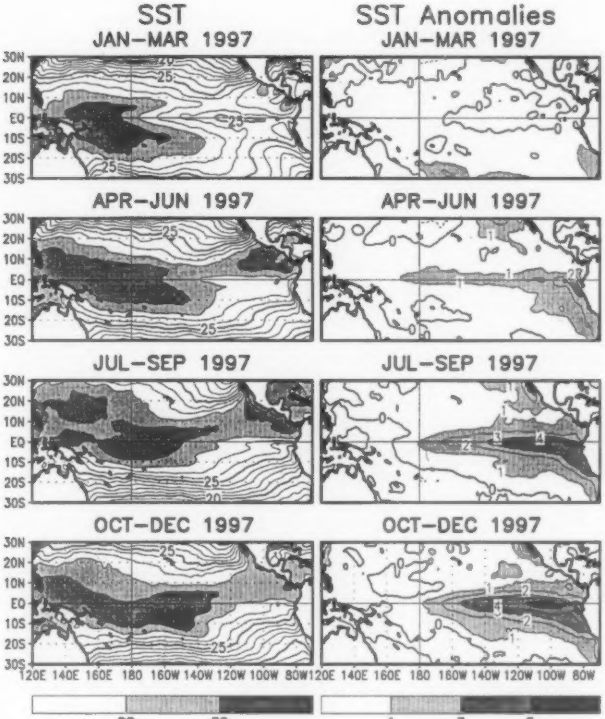


Figure 1. Mean (left) and anomalous (right) sea surface temperatures for 1997. Contour interval is 1C. Anomalies are departures from the 1950-1979 base period monthly means.

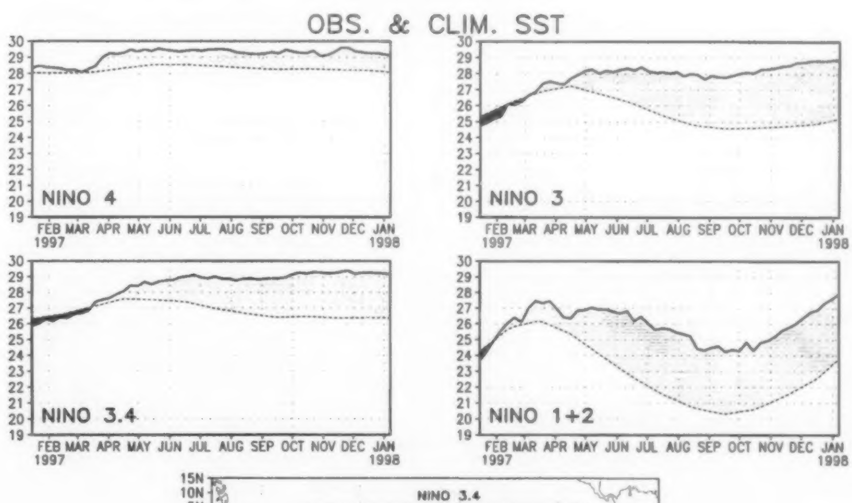


Figure 2. Observed (solid line) and climatological (dashed line) sea surface temperatures for the index regions depicted at the bottom. Positive (negative) anomalies are indicated by light (dark) shading.

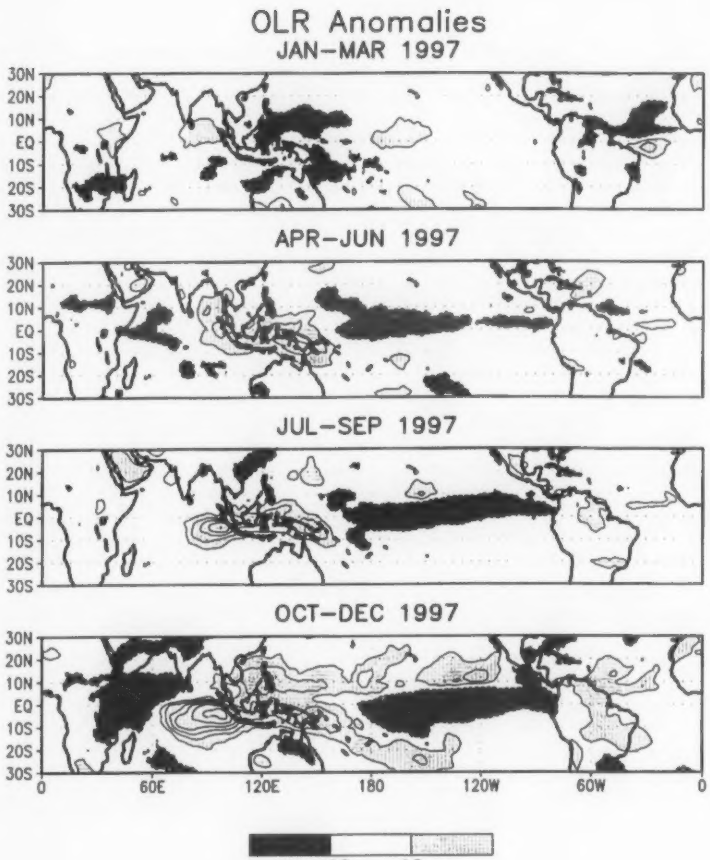


Figure 3. Anomalous outgoing longwave radiation (OLR) for 1997. Contour interval is 10 W m-2 with positive (negative) values indicated in light (dark) shading. Anomalies are departures from the 1979-1995 base period monthly means. Negative (positive) OLR anomalies in the tropics usually indicate enhanced (suppressed) convection.

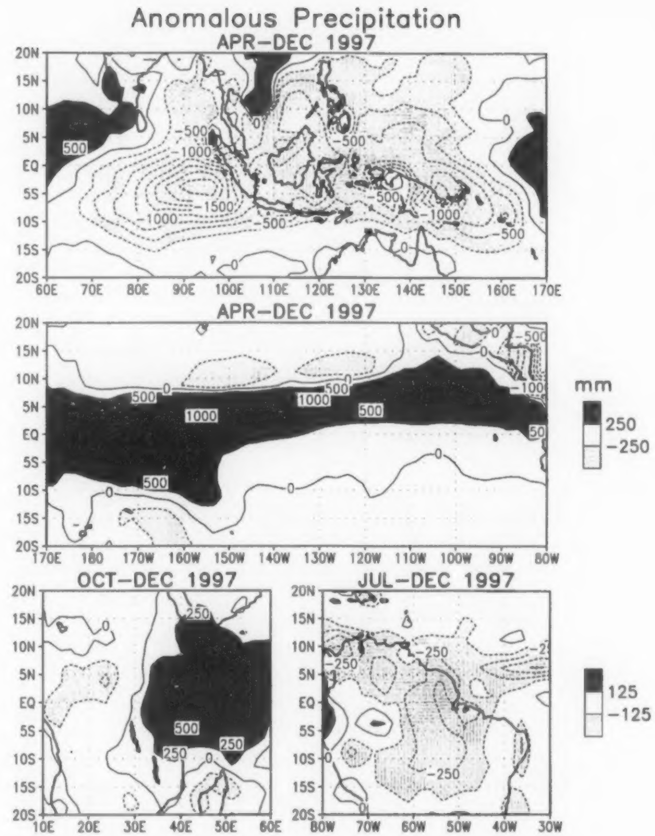


Figure 4. Estimates of precipitation anomalies (mm) for Indonesia and Malaysia (April-December 1997, top), the central and eastern tropical Pacific (April-December 1997, middle), tropical Africa (October-December 1997, bottom left), and northern South America (July-December 1997, bottom right). Analysis is obtained by merging satellite rainfall estimates with station data where available. Anomalies are departures from the 1979-1995 base period monthly means.

El Niño

Continued from Page 4

than normal conditions developed over northern South America during the summer and fall, with estimated rainfall deficits of more than 250 mm in the eastern Amazon basin (Figure 4, bottom right). Very heavy rainfall was observed over eastern tropical Africa and the western Indian Ocean during the fall, with estimated rainfall surpluses greater than 1000 mm in some areas (Figure 4, bottom left).

Over North America, wetter than normal conditions developed along the southern tier of the United States during November and December 1997. Also, warmer than normal conditions developed in December over the northern Plains and upper Midwest of the United States and over western and central Canada. Drier than normal conditions accompanied the warmer than normal temperatures in many sections. These features are typical of warm episodes.

Predictions and Expected Impacts for 1998

The National Centers for Environmental Prediction (NCEP) models and forecasts indicate that strong warm (ENSO) episode conditions will continue through spring. Thereafter, both techniques indicate a trend toward normal during the summer and fall. Based on studies documenting the historical impacts of warm episodes we can expect continued drier than normal conditions over Indonesia and Malaysia during the first half of 1998, heavier than normal rainfall over coastal sections of northern Peru and Ecuador through May, drier than normal conditions over Northeast Brazil (February-May), drier than normal conditions over southern Africa and northern Australia (through March), and wetter than normal conditions over southern Brazil, Uruguay and northeastern Argentina (through May). It is interesting to note that through December 1997, northeastern Australia and southern Africa were not greatly impacted by the intensifying warm episode. In contrast, both of these regions suffered severe droughts during the 1982-83 episode.

Over North America, we can expect a continuation through April of wetter than normal conditions over the southern tier states, and cooler than normal conditions over the Gulf Coast and southeastern states. Also, warmer and drier than normal conditions are expected for western Canada, the northern Plains, and western Great Lakes, and drier than normal conditions are expected in the Ohio Valley through March.

Weekly updates on conditions in the tropical Pacific are available on the Climate Prediction Center web site at: **http://nic.fb4.noaa.gov** (click on El Niño, then ENSO Update).

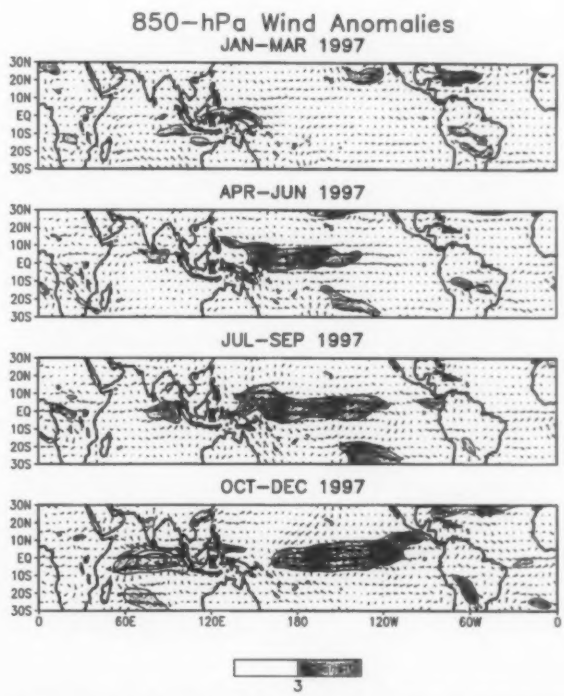


Figure 5. Anomalous 850-hPa wind for 1997. Wind speed contour interval is 3 m/s. Anomalies are departures from the 1979-1995 base period monthly means.

So Now You Have A Cadet

Prof. Sam Teel
Maine Maritime Academy
Castine, Maine

As someone who has spent the better part of a career teaching cadets at the Maine Maritime Academy, I am approached by ship's officers with comments concerning the arrival of cadets aboard their vessels. It might be useful if I pass on some of my insight as to who they are, how they got there, and what their duties are. Of course, I can only speak with first hand knowledge about the cadets from one particular maritime college; however, I believe that these ideas and suggestions will be germane for any ship and cadet.

The cadets arrive onboard having completed various levels of training. A cadet may have completed three years of formal training and have a number of voyages in his or her sea bag. For another cadet it might be that joining your vessel represents their first trip up the gangway of a real merchant vessel.

Interview

My first suggestion would be to interview the cadet in order to discover what they do or do not know. I think that a good first assignment for the cadet when reporting in would be to write up a one- or two-page "résumé" about their experience and education. Instruct them to write about the classes they have taken, any cadet time or training cruises, and what type of personal background they have with regard to living and working on the water. More specifically, ask what types of certification courses the cadet has completed. Have they had the radar or ARPA courses? Have they completed an inert gas/crude oil washing course? What about ship's medicine? All of the ship's officers should read the cadet's report. The more that is known about the cadet the better the experience will be for all parties involved.

Continued on Page 9

So Now You Have a Cadet

Continued from Page 8

Organization

Cadets will arrive with a sea project that attempts to guide them through a study of your vessel as well as requiring a significant amount of practice navigation. The successful completion of a sea project is one of the factors that the cadet's grade is based on. Think back to what you were like when you were twenty years old. Organization and self-motivation may not have been your strongest points. Likewise, the cadet coming up the gangway may benefit greatly if the ship's officers provide a little organization and motivation for them. The cadet's day should be laid out with time for watch, time for work on deck if allowable, and time to work on his or her sea project. You should inform the cadet of your expectation concerning the schedule and then make it a point to check in regularly with the cadet to ensure that they are busily doing what they are there to do. Video games and movies are not part of the drill. If they are supposed to be working on their projects between 1400 and 1600 each afternoon, swing by their stateroom and check up on them. They'll get the idea.

I suggest that you instruct the cadet to write up a weekly status report, describing what they have learned and accomplished while aboard your vessel. Establish a due date each week and ensure they hold to it. This does not need to be a long, drawn-out report; a simple one-page synopsis of the previous week would be good.

Approachability

I recently asked a large group of senior cadets what suggestions they would have me pass on to the readers of this magazine. Their most common point was that the ship's officers need to be approachable. Many of them went on to describe a very positive cadet shipping experience. The common thread seemed to be that they felt like they were part of the crew, that they were doing something useful, and that they could talk with the officers. The cadets who come on to your ship have sometimes never been out of their home state. Communicating, working, and living with a group of strangers is an intimidating experience. I do not mean that the captain needs to be buddies with the cadet; however the cadet should not be fearful of asking a question of the old man.

Expectations

In most instances the cadet is participating in some type of regimented living. This is actually a federal requirement for cadets at the state and federal maritime schools in the United States. Cadets should maintain their stateroom in a neat and organized manner with everything secured for sea. I'm not suggesting that you conduct morning inspections each day, but the cadet should understand that certain expectations are carried over from the school to the ship.

When it comes to being in port, the cadet should to be spoken to concerning their actions while off the vessel. Some of these kids are just that, kids. Set some guidelines, tell them that you expect them to behave in a professional manner while ashore. Remember that many cadets are less than 21 years old. There are certain things that they are not legally entitled to do. They represent you, your vessel, and your company. A little direction on the part of the ship's officers can prevent some embarrassing, if not dangerous, events from occurring. Think of them as your own sons or daughters. Let them know where they should and should not go and what they should and should not do.

On behalf of the instructors at the maritime schools around the world who send these young men and women out to sea, I would like to thank all of the officers who have taken the time to work with our cadets. The reports we receive when they return is that being a cadet aboard your vessel was the most significant event in their life. What occurs aboard your ship will impact them for years to come. It is a great opportunity and a great responsibility on everyone's part.⚓

1997 Hurricane Season

Dr. Jack Beven
Andrew Shashy
Tropical Prediction Center
Tropical Analysis and Forecast Branch

I. Introduction

The 1997 hurricane season differed significantly from the 1995 and 1996 seasons. Only eight tropical cyclones and one subtropical cyclone occurred in the Atlantic. These included seven tropical storms, three hurricanes, and one major hurricane (winds 100 kt. or greater). Nineteen tropical cyclones occurred over the Tropical Prediction Center's (TPC's) Eastern Pacific area of responsibility (AOR). This included 17 named storms, nine hurricanes, and seven major hurricanes. Two Pacific hurricanes (Guillermo and Linda) were estimated to be stronger than any other Eastern Pacific hurricane of record.

Three cyclones showing characteristics of both tropical and non-tropical cyclones also occurred in the Atlantic. The first section covers these 'hybrid' systems.

II. Hybrid Cyclones of 1997

Oceanic cyclones usually come in two classes. One is the baroclinic (or non-tropical or extratropical) cyclone, which gets its energy from the contrast of warm and cold air masses along a front. The other is the tropical cyclone, which is powered by the release of latent heat energy in the surrounding thunderstorm activity (convection).

Some cyclones seem to fit both categories simultaneously. These "hybrid" cyclones take a variety of forms. Some can be extratropical lows that show unusually organized convection near the center, as with a December 1994 storm off the east coast of the United States (Henson, 1995). Others appear to be tropical cyclones in distinctly non-tropical environments, like the Mediterranean "Hurricane" of January 1995 (Beven, 1997). Some cyclones transition from non-tropical to subtropical to tropical, like the Halloween storm of 1991 (Dolan and Davis, 1992; Hebert and Poteat, 1975; Henson, 1995). Other non-tropical cyclones start such a transition and never complete it.

These cyclones pose special hazards to the mariner. First, numerical weather prediction models do not handle convectively driven system well and may underforecast their intensity. Second, these systems sometimes have small cores of high winds that may escape the normal six-hourly analyses. Thus, non-synoptic-time weather reports are vital when a ship encounters such a system.

Three "hybrid" cyclones with tropical-storm force winds occurred during the 1997 hurricane season:

Continued on Page 11

Tropical Prediction Center

Continued from Page 10

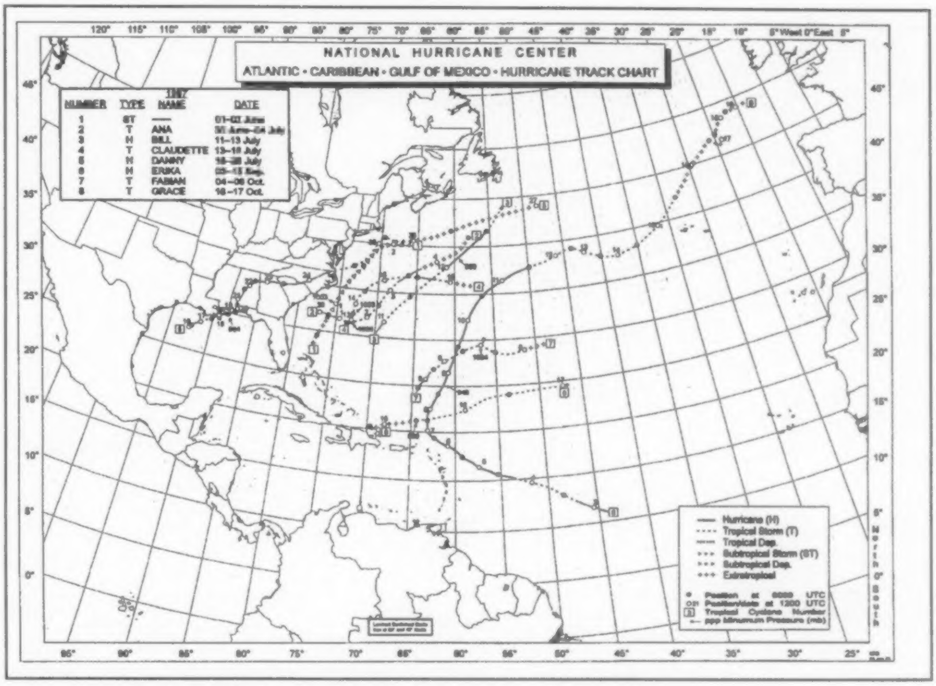


Figure 1. Atlantic tropical and subtropical cyclone tracks for 1997.

Unnumbered subtropical storm: A weak low pressure area formed over the Florida Straits on May 29. It drifted northeast for the next two days with little development. The low accelerated north-northeast late on May 31 as an approaching upper level trough enhanced the convection. The low became a subtropical depression near 31°N 76°W early on June 1 (Figure 1). Strengthening continued, and the cyclone reached a peak intensity of 45 kt. later that day. The storm turned east-northeast early on June 2 when located about 120 nm south of the New England coast. It became extratropical near 40°N 66°W late on June 2 and dissipated early on June 3.

No reporting ships encountered the storm. NOAA data buoy 41002 (32.3°N 75.2°W) reported a 10-minute sustained wind of 32 kt. between 1000-1100 UTC June 1. A Hurricane Hunter aircraft measured a 1004 MB pressure at 1930 UTC the same day. In addition, the NSCAT satellite microwave scatterometer detected winds of 40-45 kt. when it overflew the storm around 1540 UTC June 1 (Figure 2).

This system was operationally treated as an extratropical gale in high seas and offshore forecasts. A post-storm analysis determined that it met the TPC criteria of a subtropical storm.

Eastern Atlantic "Hybrid," October 2-7, 1997: An area of low pressure drifted west-southwest from the Iberian Peninsula in late September. It started showing central convection near 26°N 12°W on October 2. It drifted southwest to near 33°N 15°W by October 4 with little further development. Then it turned east-northeast and strengthened on October 5. This motion continued into October 6 when the system briefly formed an eye. Unfavorable upper level winds caused rapid weakening as the cyclone moved near Gibraltar early on October 7, and the system dissipated over the extreme western Mediterranean later that day.

Ship **DPUF4** (name not available) reported 45 kt. sustained winds at 1200 UTC October 5 outside the cyclone core. Satellite intensity

Continued on Page 12

Tropical Prediction Center

Continued from Page 11

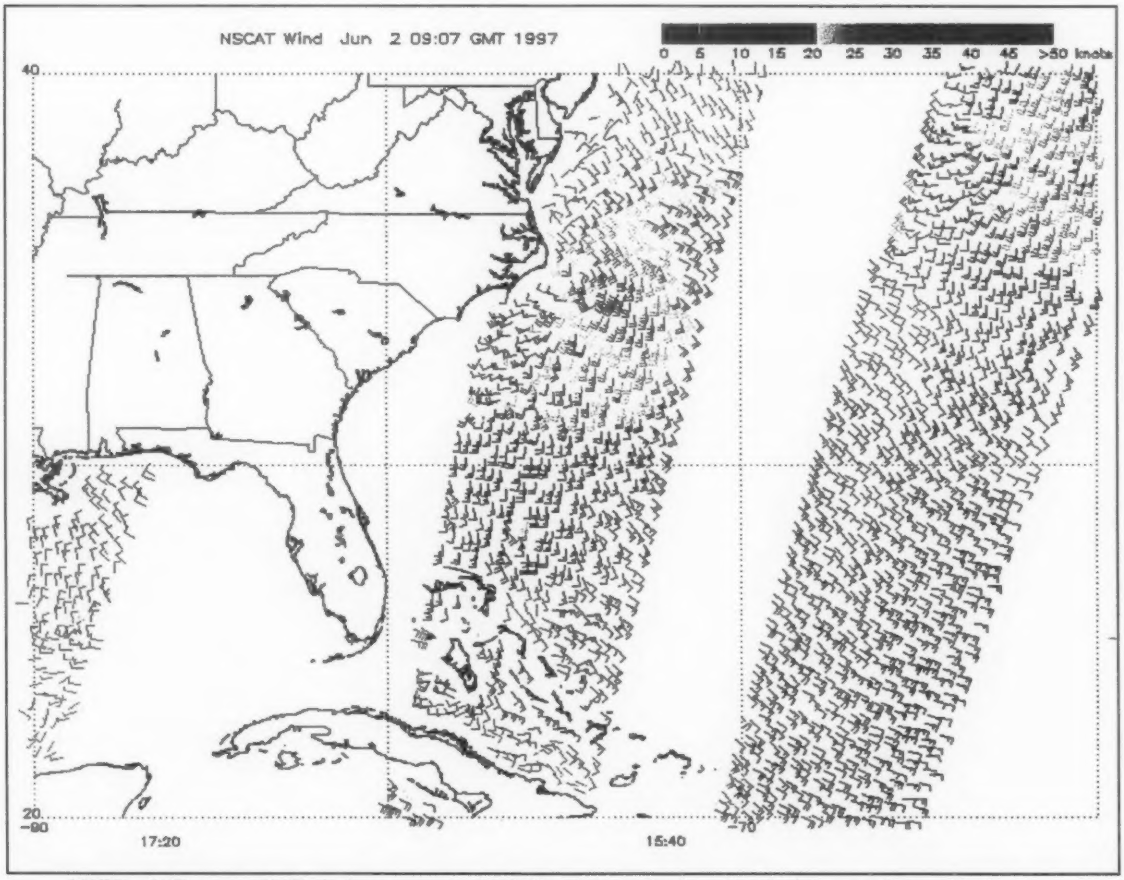
estimates (using the Hebert-Poteat [1975] scheme) suggest a peak intensity of 55-65 kt. early on October 6, but no observations exist to verify this. Due to its origin, and to the cool atmosphere and sea surface temperatures in the area, the exact nature and intensity of the cyclone are uncertain. The TPC would like to hear from any mariner who may have encountered the core of this cyclone.

This system was carried as an extratropical gale in forecasts issued by the United Kingdom Meteorological Office, with the TPC forecasters coordinating with their British counterparts.

During this time, a low near 28°N 42°W also tried to develop into a subtropical or tropical cyclone. However, convection never persisted near the center, and the system fizzled without developing tropical storm force winds.

Second Eastern Atlantic "Hybrid," October 25-27, 1997: This system formed from a frontal low first seen near the southeast U.S. coast on October 19. By October 22, the low had moved to 43°N 42°W. It then turned southeast toward the Azores. Persistent central convection formed on October 25 as the low passed through the Azores. The cyclone then moved east-northeast until landfall on the Spain-northern

Continued on Page 13



NOTE: (1) Times are GMT; (2) times correspond to 30N at right swath edge—time is right swath for overlapping swaths at 30N; (3) data buffer is Jun 2 09:07 GMT 1997—22 hrs.

Figure 2. NSCAT Scatterometer data for the Unnumbered Subtropical Storm, 1 June 1997. Data courtesy of the NOAA NESDIS/Office of Research and Applications.

Tropical Prediction Center

Continued from Page 12

Portugal border on October 27. It weakened over land later that day, losing any "tropical" characteristics.

Surface observations in the Azores show a central pressure near 991 MB on October 25, while observations on the Iberian Peninsula show a central pressure near 1000 MB on October 27 along with 30 kt. sustained winds. Ships avoided the core area of the storm, with peripheral observations of 30-40 kt. winds. Satellite estimates suggest 35-40 kt. winds. As with the earlier storm, the exact nature and intensity are uncertain.

The waters around the Azores frequently see slow-moving lows cut off from the westerlies, which on rare occasions develop into tropical cyclones. The best known example is Hurricane Ivan in October 1980 (Pelissier and Lawrence, 1981).

Besides these systems, Tropical Storm Ana, Hurricane Bill, Tropical Storm Claudette, Hurricane Danny, and Tropical Storm Grace all formed from non-tropical low pressure systems.

III. Significant Weather of the Period

A. Tropical Cyclones: Please note that all times are UTC.

1. Atlantic

Tropical Storm Ana: A tropical depression formed from a frontal low near 30°N 72°W on June 30 (Figure 1). It drifted east on July 1 and became a tropical storm. Ana continued east on July 2 as it reached a peak intensity of 40 kt. and an aircraft-measured minimum pressure of 1000 MB. The storm accelerated northeastward later on July 2, and this motion continued until the system became extratropical near 38°N 65°W on July 4.

There are no known ship reports of 34 kt. or greater winds associated with Ana.

Hurricane Bill: An upper level trough produced an area of low pressure east of the Bahamas during July 8-10. Convection organized near the low center, and the system became a tropical depression near 30°N 70°W on July 11 (Figure 1). The cyclone initially moved northeast, and this motion continued with acceleration through its lifetime. The depression reached tropical storm strength later on July 11. Bill continued to develop and it reached minimal hurricane strength (65 kt.) about 1200 UTC July 12. An eye appeared in satellite imagery at this time. Bill weakened to a tropical storm before merging with a cold front near 44°N 53°W on July 13.

There are no known ship reports of 34 kt. or greater winds associated with Bill.

Tropical Storm Claudette: The cold front that absorbed Bill spawned a low near 31°N 73°W on July 11. The system moved little for the next two days as it separated from the front and developed central convection. The low became both a tropical depression and a tropical storm on July 13 (Figure 1). Unfavorable upper level winds stopped further development on July 14, and Claudette drifted north to northeast at its peak intensity of 40 kt. It turned east and accelerated on July 15, and this track continued through July 16 when the system became extratropical near 36°N 58°W. The remnant low continued generally east and dissipated near the Azores on July 23.

There are no known ship reports of 34 kt. or greater winds associated with Claudette.

Hurricane Danny: An upper level low pushed a cluster of strong thunderstorms southward into the Gulf of Mexico on July 13. A low formed over the northern Gulf on July 14 with slow development during the next day. The low became a tropical depression near 27°N 93°W on July 16 (Figure 1) while drifting northeast. Slow development and drifting continued until the system reached tropical storm strength on July 17. Danny strengthened more quickly and reached hurricane strength just before crossing the mouth of the Mississippi River early on July 18.

Danny continued slowly northeast across the Gulf coastal waters until it made landfall over Mobile Bay around 1000 UTC July 19. At that time, it reached the peak intensity of 70 kt. with an aircraft-measured minimum pressure of

Continued on Page 14

Tropical Prediction Center

Continued from Page 13

984 MB. The cyclone drifted east into the western Florida Panhandle on July 20 as it weakened to a tropical depression.

Danny was not yet finished. The depression remained well organized as it drifted across Alabama and Georgia during July 21-23. The cyclone reintensified while moving across North Carolina on July 24, and it regained tropical storm strength when moving off the coast south of Norfolk, Virginia late that day. The rejuvenated Danny tracked northeast to just southeast of Cape Cod late on July 25. It then made a small loop and headed east out to sea. Danny became extratropical near 41°N 68°W on July 26, with the remnant low merging with a cold front late on July 27.

Shipping generally avoided Danny, and no reports of 34 kt. or greater winds have been received at the TPC. However, the storm passed over several automated buoys and Coastal Marine Automated Network (C-MAN) stations. The Dauphin Island, Alabama C-MAN reported 65 kt. sustained winds with a peak gust to 88 kt. It also reported a minimum pressure of 987.8 MB. The Grand Isle, Louisiana, C-MAN reported an 83 kt. gust. The Chesapeake Light, Virginia C-MAN reported 51 kt. sustained winds with a gust to 61 kt. as Danny moved offshore. Finally, NOAA buoy 44014 (36.6°N 74.8°W) reported 42 kt. sustained winds with a gust to 54 kt.

Danny's slow movement over southwest Alabama resulted in tremendous rainfall, with the Dauphin Island Sea Lab reporting a storm total of 36.71 in. Coastal storm tides were generally 2-5 ft. along the Alabama coast with a maximum value of 6.5 ft.

Danny is directly responsible for four deaths in the U.S. with five additional indirect deaths. Damage is estimated at $100 million.

Tropical Depression Five: Tropical Depression Five formed from a tropical wave on July 17 near 12°N 52°W. It moved steadily west-northwest through its lifetime. A reconnaissance aircraft suggested the system was near tropical storm strength late on July 17. However, unfavorable upper level winds stopped further development and caused the system's eventual demise. The cyclone weakened to an open wave near 15°N 60°W on July 19.

Hurricane Erika: A tropical wave moved off the African coast on August 31. The system organized into a tropical depression near 11°N 44°W on September 3 (Figure 1) and became a tropical storm later that day.

Erika tracked to the west-northwest for the next three days while gradually strengthening. Despite somewhat unfavorable upper level winds, it reached hurricane strength late on September 4. The storm slowed as it approached the Leeward Islands, and Erika was just northeast of them when it turned north-northeast late on September 7. Significant strengthening occurred after the turn, and Erika reached a peak intensity of 110 kt. on September 8-9. During this time, a reconnaissance aircraft measured a minimum pressure of 946 MB.

A weakening Erika moved northeast during September 11-12 as it weakened to a tropical storm. The storm turned east-southeast on September 13 before resuming a northeast motion on September 15. This lasted until the cyclone became extratropical near 42°N 28°W on September 16. The remnant low continued northeast for three more days before dissipating.

Erika's turn spared the Leeward Islands, and there are no island reports of sustained tropical storm-force winds. However, many ships encountered the hurricane. An unidentified ship twice reported 60 kt. winds on September 14-15, and there are numerous other reports of 34 kt. or greater. A NOAA drifting buoy reported 60 kt. winds on September 4. Erika passed northwest of the Azores while becoming extratropical and produced a gust to 76 kt. on Flores.

There are no reports of damage or casualties due directly to Erika. Two surfers died due to high wave action.

Tropical Storm Fabian: A tropical depression formed near 24°N 65°W on October 4 from a tropical wave that had tracked

Continued on Page 15

Tropical Prediction Center

Continued from Page 14

across the northeast Caribbean islands. The system moved northeast and reached tropical storm strength the next day. Fabian continued northeast through October 7, then it moved generally east until it became extratropical near 29°N 51°W on October 8.

Ship **ZCBB7** (name not available) reported 40 kt. winds at 1200 UTC October 8. This report was used operationally to upgrade Fabian to a tropical storm. However, post-analysis of satellite imagery indicates Fabian reached storm strength on October 5, and at the time of the ship report it was becoming extratropical.

Tropical Storm Grace: During the second week of October, a frontal trough extended from the central Atlantic into the western Caribbean. A low formed near 20°N 69°W on October 14 and developed gale-force winds early on October 15. Convection developed near the center and the low became Tropical Storm Grace early on October 16 (Figure 1). Grace moved east-northeast along the frontal trough and lost its tropical characteristics near 25°N 47°W on October 17. The maximum sustained winds were estimated at 40 kt.

There are no known ship reports of 34 kt. or greater winds associated with Grace during its tropical storm phase.

2. Pacific

Tropical Storm Andres: Tropical Depression 1-E formed near 10°N 95°W on June 1 (Figure 3). It moved northwest and became a tropical storm the next day. Andres turned northeast on June 3 and east on June 4 as it reached a peak intensity of 45 kt. Andres moved southeast on June 5-6 as it weakened to a depression, then it turned north and made landfall over El Salvador on June 7.

Continued on Page 16

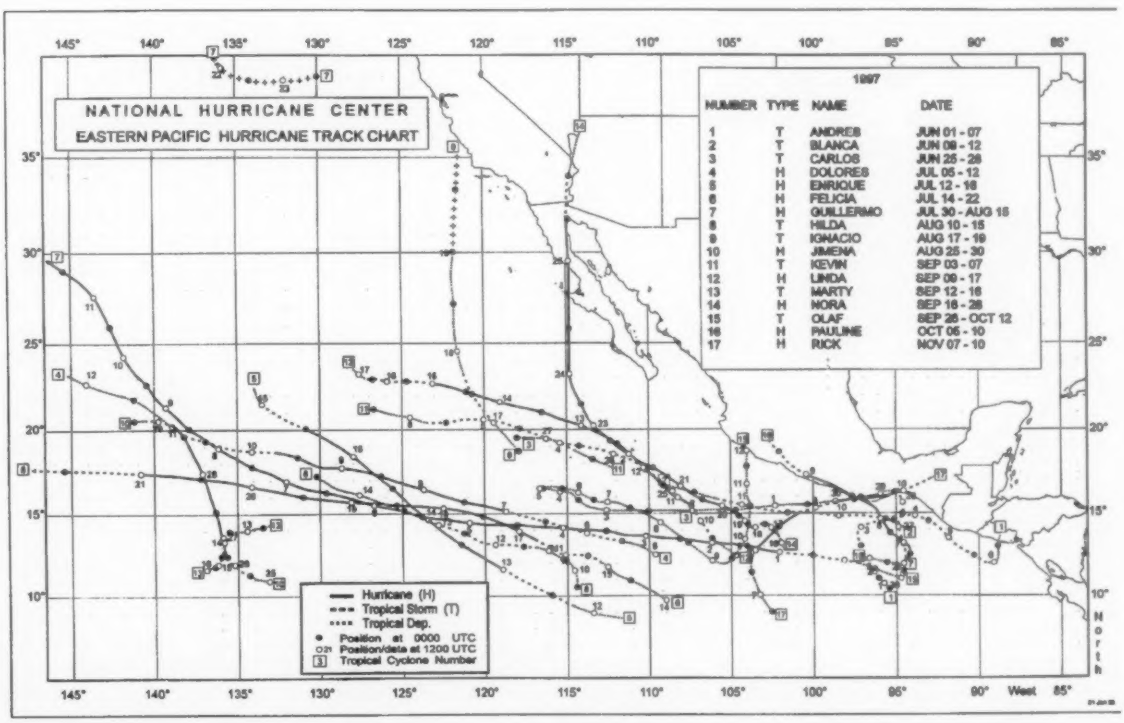


Figure 3. Eastern North Pacific tropical cyclone tracks for 1997.

Tropical Prediction Center

Continued from Page 15

Andres' remains moved into the Caribbean and Gulf of Mexico during June 8-10, where they helped produce heavy rains over south Florida, Cuba, and the Bahamas.

The eastward track and the landfall over El Salvador are both unique in the records of Eastern Pacific tropical cyclones. There are no known ship reports of 34 kt. or greater winds associated with Andres.

Tropical Storm Blanca: Tropical Depression 2-E formed near 14°N 95°W on June 9 (Figure 3). Moving a little north of west, the cyclone reached tropical storm strength the next day. Blanca reached a peak intensity of 40 kt. late on June 10. A weakening trend started, and Blanca dissipated near 17°N 109°W on June 12.

There are no known ship reports of 34 kt. or greater winds associated with Blanca.

Tropical Depression 3-E: Tropical Depression 3-E formed near 14°N 117°W on June 21. It moved west until it dissipated near 15°N 128°W on June 24. Maximum sustained winds were estimated at 30 kt.

Tropical Storm Carlos: Tropical Depression 4-E formed near 16°N 108°W on June 25 (Figure 3). Moving northwest, it reached tropical storm strength later that day. Carlos turned west-northwest on June 26 as it reached a peak intensity of 45 kt. After that, the cyclone weakened until it dissipated near 20°N 118°W on June 28.

There are no known ship reports of 34 kt. or greater winds associated with Carlos. However, the storm passed about 40 miles southwest of Socorro Island, which reported 35 kt. sustained winds with a gust to 51 kt.

Tropical Depression 5-E: Tropical Depression 5-E formed near 14°N 109°W on June 29. Initially moving west-northwest, the system turned west on June 30 and maintained this motion through July 2. It turned west-southwest on July 3 and dissipated near 14°N 124°W on July 4. Maximum sustained winds were estimated at 30 kt.

Hurricane Dolores: Tropical Depression 6-E developed near 13°N 110°W on July 5 (Figure 3). It followed a general west-northwest track through its lifetime. The cyclone became a tropical storm early on July 6 and a hurricane on July 7. The peak intensity was 80 kt. on July 9. Dolores weakened to a tropical depression before crossing 140°W into the Central Pacific Hurricane Center (CPHC) AOR on July 11. It dissipated the next day near 23°N 145°W.

There are no known ship reports of 34 kt. or greater winds associated with Dolores.

Hurricane Enrique: Tropical Depression 7-E formed near 9°N 112°W on July 12 (Figure 3). Moving northwest, the system rapidly strengthened into a tropical storm later that day and a hurricane the next day. Enrique reached a peak intensity of 100 kt. on July 14. Equally rapid weakening began as the cyclone continued northwest, and Enrique dissipated on July 16 near 23°N 134°W.

There are no known ship reports of 34 kt. or greater winds associated with Enrique.

Hurricane Felicia: Tropical Depression 8-E formed near 10°N 109°W on July 14 (Figure 3). The cyclone initially moved west-northwest, and this motion continued until July 18. Slow development occurred, with the depression reaching tropical storm strength on July 15 and hurricane strength on July 17. Felicia turned to a just north of west track on July 18 and rapidly intensified. It reached a peak intensity of 115 kt. the next day. Weakening then began, and Felicia was a tropical storm when it crossed into the CPHC AOR on July 21. The cyclone dissipated near 18°N 150°W on July 22.

There are no known ship reports of 34 kt. or greater winds associated with Felicia.

Hurricane Guillermo: Tropical Depression 9-E formed near 11°N 95°W on July 30 (Figure 3). Moving west-northwest, the cyclone reached tropical storm strength the next day. Guillermo

Continued on Page 17

Tropical Prediction Center

Continued from Page 16

continued moving west-northwest and intensifying through August 4. It became a hurricane on August 1 and a reached peak intensity of 140 kt. on August 4. Guillermo turned west on August 5, then resumed a west-northwest track on August 6. Slow weakening occurred, and the cyclone weakened to a tropical storm on August 8. The storm turned northwest and crossed into the CPHC AOR on August 9. A general northwest motion continued through August 15. Guillermo weakened to a depression on August 10, but regained tropical storm strength the next day. It reached a second peak intensity of 55 kt. on August 14. The cyclone turned north-northwest late on August 15 as it weakened to a depression, then became extratropical near 42°N 161°W on August 16. The remnant low turned east and finally dissipated near 39°N 131°W on August 24.

Based on satellite imagery, Guillermo was the strongest hurricane of record in the Eastern North Pacific (until Linda came along in September). NOAA research aircraft measured a central pressure near 930 MB before the storm reached its peak satellite appearance.

Shipping avoided Guillermo while it was east of 140°W. However, ship **ELLE3 (Van Trader)** reported 40 kt. winds at 1200 UTC August 12 as it encountered Guillermo northeast of Hawaii.

Tropical Storm Hilda: Tropical Depression 10-E formed near 11°N 114°W on August 10 (Figure 3). Initially moving north to northwest, the cyclone turned west-northwest on August 11 as it became a tropical storm. A brief turn to the west occurred on August 12 as Hilda reached a peak intensity of 45 kt. Hilda weakened and resumed a west-northwest track on August 13, and it dissipated near 17°N 130°W on August 15.

There are no known ship reports of 34 kt. or greater winds associated with Hilda.

Tropical Storm Ignacio: Tropical Depression 11-E formed near 19°N 118°W on August 17 (Figure 3). The cyclone moved northwest as it reached its peak intensity of 35 kt. (minimal tropical storm strength) later that day. Ignacio turned north on August 18 and weakened to a depression, and it continued this motion until it became extratropical near 30°N 122°W on August 19. The remnant low continued north until it dissipated near 35°N 122°W on August 20.

There are no known ship reports of 34 kt. or greater winds associated with Ignacio. The cyclone's northward track brought record August rains to parts of central California.

Hurricane Jimena: Tropical Depression 12-E formed near 11°N 133°W on August 25 (Figure 3). Moving northwest, the cyclone reached tropical storm strength early on August 26 and hurricane strength early on August 27. Jimena turned north-northwest and rapidly intensified to a peak intensity of 115 kt. late on August 27. Rapid weakening followed, and Jimena was back to a tropical depression by late August 29 as it turned west-northwest into CPHC's area of responsibility. It dissipated the next day near 21°N 141°W.

There are no known ship reports of 34 kt. or greater winds associated with Jimena.

Tropical Storm Kevin: Tropical Depression 13-E formed near 18°N 112°W on September 3 (Figure 3). Moving west-northwest, it became a tropical storm the next day with a peak intensity of 50 kt. early on September 5. Kevin then turned west and weakened. It became a depression on September 6 and dissipated the next day near 21°N 127°W.

The ship **Kentucky Highway** passed about 110 nm from Kevin's center and reported 39 kt. sustained winds at 1800 UTC September 4.

Hurricane Linda: Tropical Depression 14-E formed near 12°N 105°W on September 9 (Figure 3). Moving northwest, the system reached tropical storm strength the next day and hurricane strength early on September 11. Explosive deepening then occurred, with satellite estimates showing Linda's winds increased from 65 kt. to 155 kt. in 24 hours! Linda reached a peak intensity of

Continued on Page 18

Tropical Prediction Center

Continued from Page 17

160 kt. with an estimated minimum pressure of 902 MB at 0600 UTC September 12, making it the strongest hurricane of record in the Eastern North Pacific. The hurricane made a gradual turn to the west-northwest on September 13-14 as it slowly weakened. Rapid weakening started later on September 14, and Linda dropped below hurricane strength on September 15 while turning west. The storm weakened to a depression on September 17, and it dissipated later that day near 24°N 128°W.

Like Guillermo, Linda's peak intensity is based on satellite estimates, as no observations are available from the core during that time. The storm passed near Socorro Island near peak intensity. However, the instruments there failed before the worst conditions arrived. Several ships outside the core reported tropical storm force winds, including a report of 45 kt. from the **KLHZ (Chevron Colorado)** at 2100 UTC September 12.

Some computer models indicated that Linda might turn north and threaten southern California. This fortunately was incorrect, and the storm avoided all land except Socorro Island. However, large swells from the hurricane affected large stretches of the Mexican and southern Californian coasts.

Tropical Storm Marty: Tropical Depression 15-E formed near 14°N 133°W on September 12 (Figure 3). Moving just south of due west, the system slow intensified to tropical storm strength on September 14. Marty turned west southwest later that day as it reached a peak intensity of 40 kt. This motion continued through September 15 as Marty weakened to a depression. The cyclone dissipated the next day near 12°N 137°W.

There are no known ship reports of 34 kt. or greater winds associated with Marty.

Hurricane Nora: Tropical Depression 16-E formed near 13°N 102°W on September 16 (Figure 3). The system moved erratically near that location through September 19 before starting a northwest track on September 20. It became a tropical storm on September 16 and a hurricane on September 18. Nora reached a first peak intensity of 90 kt. later that day. It then slowly weakened through September 20. The hurricane continued northwest through September 23 before turning north the next day. Nora rapidly intensified to a peak intensity of 115 kt. on September 21. Gradual weakening occurred after that. The storm accelerated north and made landfall in Central Baja California on September 25 with 75 kt. winds. It then moved along the west coast of the Gulf of California and up the Colorado River Valley. Nora dissipated over the western United States on September 26.

Several ships encountered Nora. The strongest winds were from the **ZCBL6** (name not available), which reported 48 kt. sustained winds and a 989.0 MB pressure at 2100 UTC September 24 and 50 kt. sustained winds three hours later. Additionally, Yuma, Arizona, reported 39 kt. sustained winds, making Nora the first Eastern North Pacific tropical cyclone to cause tropical storm force winds in the United States since Kathleen in 1976.

Nora's landfall in Mexico caused two deaths, with up to 400 people made homeless. Initial media reports suggest Nora was indirectly responsible for three or four traffic deaths in southern California along with damage to agriculture estimated in the hundreds of millions of dollars.

Tropical Storm Olaf: Tropical Depression 17-E formed near 11°N 95°W on September 26. Drifting north, it became a tropical storm later that day. Olaf continued north until it made landfall near Salina Cruz, Mexico early on September 29. It reached a peak intensity of 60 kt. just before landfall. After landfall, Olaf turned west along the southern coast of Mexico and weakened to a tropical depression. The disorganized cyclone moved back over the Pacific on September 30. Although Olaf never regained tropical storm strength, it persisted for almost two more weeks. It tracked west through October 5 to near 17°N 117°W, then moved east-southeast to near 12°N 105°W by October 10. A northward motion followed, and Olaf made a second landfall near

Continued on Page 19

Tropical Prediction Center

Continued from Page 18

Manzanillo, Mexico late on October 12. It dissipated over land shortly thereafter.

Ship **OUJH2 (Majestic Maersk)** reported 55 kt. sustained winds at 0300 UTC September 27, which is the basis for Olaf's peak intensity. Several other ships encountered Olaf later, but none reported tropical storm-force winds.

Media reports indicate three fishing vessels were reported missing off the Mexican coast during Olaf. Heavy rains from the storm affected a wide area of the coast from El Salvador to central Mexico.

Hurricane Pauline: Tropical Depression 18-E formed near 12°N 97°W on October 5. The cyclone moved slowly east and reached tropical storm strength the next day. Pauline turned north and then northwest on October 7 as it rapidly strengthened to a peak intensity of 115 kt. The hurricane moved west northwest on October 8 with winds in the 100-115 kt. range, then it made landfall early on October 9 near Puerto Escondido, Mexico, with 95 kt. winds. Pauline continued west-northwest over the southern Mexican mountains until it dissipated near Tuxpan on October 10.

The most significant marine observation was from the **Rijndam**, which reported 51 kt. sustained winds at 0600 UTC October 7 while about 120 northeast of Pauline's center. Land observations are incomplete. However, Acapulco reported 40 kt. sustained winds with gusts to 51 kt. at 0745 UTC October 9.

Pauline's track across southern Mexico resulted in rainfalls up to 16 in. These caused severe flooding, especially in the Acapulco area. The estimated death toll ranges from 230-400.

Hurricane Rick: Tropical Depression 19-E formed near 9°N 103°W on November 7. Initially moving northwest, the cyclone gradually turned to the northeast on November 8 as it reached tropical storm strength. Rick

Continued on Page 20

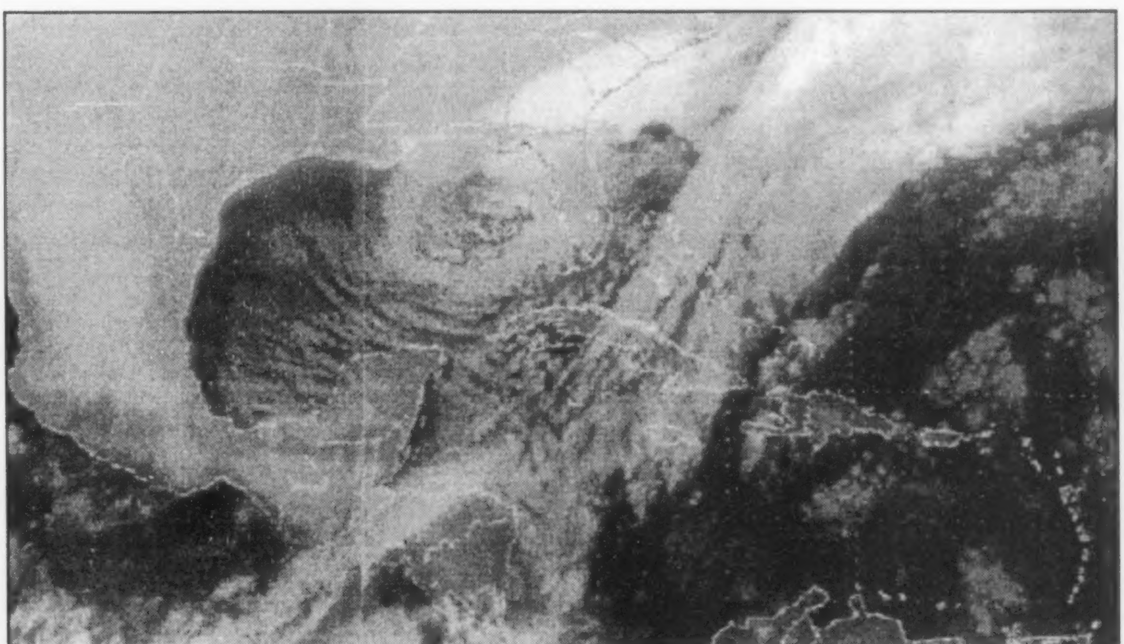


Figure 4. GOES-8 Infrared imagery at 0845 UTC 15 December.

Tropical Prediction Center

Continued from Page 19

moved east-northeast and became a hurricane on November 9 with a peak intensity of 85 kt. later that day. The hurricane made landfall near Puerto Escondido, Mexico, with 75 kt. winds early on November 10, then it weakened below tropical depression status later that day. The remnant low was last seen over the Bay of Campeche on November 11.

Ship **ZCBD9 (Chiquita Francis)** reported 39 kt. sustained winds at 0000 UTC November 10. Puerto Escondido reported 65 kt. sustained winds at 0200 UTC November 10.

Rick spread heavy rains across much of the area affected by Pauline a month earlier. There are no reports of injuries or deaths, and media reports suggest only minor damage.

B. Other Significant Events

The most notable weather events for the TPC marine forecast areas occurred in the Atlantic. Typical warning events occur with strong cold fronts entering the Gulf of Mexico and the Atlantic Ocean. However, several episodes of strong gale and storm force conditions did occur in the Pacific in the Gulf of Tehuantepec (approximately near 15°N 95°W),

Continued on Page 21

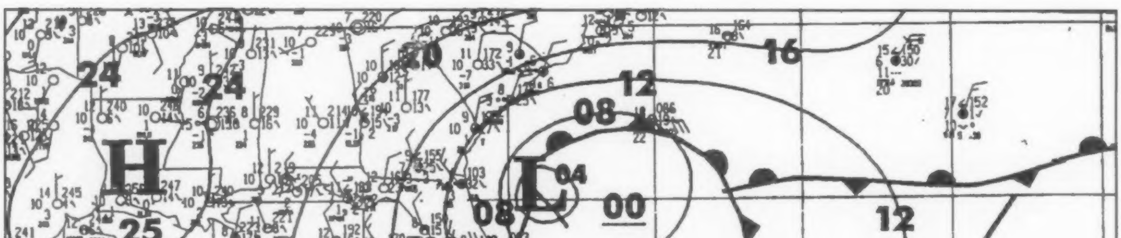


Figure 5. TAFB surface analysis at 1800 UTC 15 December 1997.

Tropical Prediction Center

Continued from Page 20

which is not uncommon during the fall and winter. These situations occur when strong cold fronts enter the Gulf of Mexico followed by strong high pressure (at least 1025 MB) over the Southeast United States. Since the area is infrequently traveled by weather reporting ships, one of the best tools to use in examining strong gale conditions is the Special Sensor Microwave Imager (SSM/I) data from the Defense Meteorological Satellite Program (DMSP) satellite. Over oceans, the data are color coded to show different wind speeds. For example, a yellow area indicates 25-33 knots and a red area indicates 34 knots or greater.

One major event in TPC's Atlantic AOR during the fall/winter 1997 was a coastal storm that developed off the Northeast Florida and Georgia coasts from December 14-16. This strong low developed along a frontal boundary and rapidly intensified on December 14 and then weakened on December 17. A GOES-8 infrared satellite image at 0845 UTC December 15 (Figure 4) shows the frontal system over the West Atlantic and central Cuba with the low pressure center near North Florida. Numerous reports of gale force winds were measured from ships and moored platforms. From December 15-16, two ships with call signs **DVRA (Nedlloyd Chile)** and **KMJL (Groton)** reported storm force winds of 52 and 51 knots and combined seas of about 18 to 23 feet. These two reports were invaluable in assessing the strength and location of the storm center. Some sea heights from this event were in the 20-28 foot range. Strongest winds around the low pressure center over the Atlantic were confined between 28°N-35°N and between 74°W-80°W. In addition, gale force conditions were observed over a large part of the Gulf of Mexico. The central pressure of the storm may have dropped to as low as 998 MB during the afternoon on December 15 (Figure 5). Notice also the strong high pressure over Louisiana that produced storm force winds of 50 knots and seas near 25 feet within 150-180 nm of the Gulf of Tehuantepec coast.

Media reports indicated partial damage to a beach pier in Fernandina Beach and a barge that ran aground on the Florida coast. In addition, at least 2 search and rescue missions were made by the U.S. Coast Guard due to crippled vessels near the Florida Keys during the event on December 15 due to near gale force conditions.

Other strong gale events that occurred over the TPC Atlantic forecast area during fall and winter 1997 were as follows:

- On October 15 1997, Gulf of Mexico gales of 40 knots and 18 feet behind a cold front.
- From November 3-5, a gale center formed near 29°N 36°W that produced gales of 45 knots and 20-25 foot combined seas.
- From November 6-8, a gale center formed near 25°N 50°W that produced gales of 45 knots and 22 foot combined seas.
- From December 26-28, moderate gale force winds of 40 knots over the Gulf of Mexico and West Atlantic waters were due to a gale center and strong cold front that moved off the Southeast U.S.

IV. References

Beven, J. L., 1997: A Study of Three Hybrid Storms. *Preprints, 22nd Conf. on Hurricanes and Tropical Meteorology*, Ft. Collins, CO. Amer. Meteor. Soc., 645-646.

Dolan, R., and R. E. Davis, 1992: Rating northeasters. *Mariners Weather Log*, **36**, 4-11.

Hebert, P. J., and K. O. Poteat, 1975: A satellite classification technique for subtropical cyclones. NOAA Technical Memorandum NWS SR-83, U.S. Dept. Of Commerce, National Weather Service, Ft. Worth TX, 25 pp.

Henson, R., 1995: Hurricanes in disguise. *Weatherwise*, **48**, #6, 12-17.

Pelissier, J. M., and M. B. Lawrence, 1981: North Atlantic tropical cyclones, 1980: *Mariners Weather Log*, **25**, 79-91.

1998 Hurricane and Cyclone Names

Atlantic, Gulf of Mexico, and Caribbean Sea

Alex	Hermine	Otto
Bonnie	Ivan	Paula
Charlie	Jeanne	Richard
Danielle	Karl	Shary
Earl	Lisa	Tomas
Frances	Mitch	Virginie
Georges	Nicole	Walter

Eastern North Pacific (east of 140W)

Agatha	Isis	Roslyn
Blas	Javier	Seymour
Celia	Kaye	Tina
Darby	Lester	Virgil
Estelle	Madeline	Winifred
Frank	Newton	Xavier
Georgette	Orlene	Yolanda
Howard	Paine	Zeke

Central North Pacific (from the dateline to 140W)*

Akoni	Aka	Alika	Ana
Ema	Ekeka	Ele	Ela
Hana	Hali	Huko	Halola
Io	Iolana	Ioke	Iune
Keli	Keoni	Kika	Kimo
Lala	Li	Lana	Loke
Moke	Mele	Maka	Malia
Nele	Nona	Neki	Niala
Oka	Oliwa	Oleka	Oko
Peke	Paka	Peni	Pali
Uleki	Upana	Ulia	Ulika
Wila	Wene	Wali	Walaka

Western North Pacific (west of the dateline)*

Ann	Abel	Amber	Alex
Bart	Beth	Bing	Babs
Cam	Carlo	Cass	Chip
Dan	Dale	David	Dawn
Eve	Ernie	Ella	Elvis
Frankie	Fern	Fritz	Faith
Gloria	Greg	Ginger	Gil
Herb	Hannah	Hank	Hilda
Ian	Isa	Ivan	Iris
Joy	Jimmy	Joan	Jacob
Kirk	Kelly	Keith	Kate
Lisa	Levi	Linda	Leo
Marty	Marie	Mort	Maggie
Niki	Nestor	Nichole	Neil
Orson	Opal	Otto	Olga
Piper	Peter	Penny	Paul
Rick	Rosie	Rex	Rachel
Sally	Scott	Stella	Sam
Tom	Tina	Todd	Tanya
Violet	Victor	Vicki	Virgil
Willie	Winnie	Waldo	Wendy
Yates	Yule	Yanni	York
Zane	Zita	Zeb	Zia

* Each year in the Central and Western North Pacific, the next name is just the one following the last from the previous year. Once through a list, the next name will be off the top of the next list.⚓

NOAA's Aircraft Operations Center

Jeff Hagan
Public Affairs Officer
Aircraft Operations Center (AOC)
MacDill AFB, Florida

The National Oceanic and Atmospheric Administration is one of the leading scientific agencies in the U.S. government. Its mission is to promote global environmental stewardship and to describe and predict changes in the earth's environment.

NOAA accomplishes this mission through its six divisions: the National Weather Service, the National Marine Fisheries Service, the National Environmental Satellite Data and Information Service, the Office of Oceanic and Atmospheric Research, the National Ocean Service, and the Office of NOAA Corps Operations.

NOAA's Aircraft Operations Center (AOC), under the Office of NOAA Corps Operations, was established to provide the airborne platforms necessary to collect the scientific and geographic data essential to these agencies.

AOC's Heavy Aircraft Program operates two of the world's premier research aircraft, the NOAA WP-3D Orion "Hurricane Hunters." These versatile, highly capable platforms participate in a wide variety of meteorological and oceanographic experiments on a world wide basis, as well as the hurricane research and reconnaissance for which they are best known.

Ten small aircraft—a mix of jet, turboprop, and pistonpowered single and twin engine aircraft—make up the Light Aircraft Program. NOAA's two Dehavilland DHC-6 Twin Otters have proven to be an ideal platform for low-level, slow speed aerial surveys, such as marine mammal and sea turtle counts, or Fisheries enforcement. An AC-500 Aero Commander is equipped with a gamma ray spectrophotometer which measured the background level of natural gamma radiation in the summer, and again with winter's snow cover. The difference allows hydrologists to determine water content for spring and summer flooding predictions. NOAA's Cessna Citation, used for nautical charting and airport obstruction programs, is one of the world's most advanced photogrammetry platforms with its side-by-side dual camera layout and coupled GPS navigation system.

The three rotocraft of AOC's Helicopter Program have been called upon to perform a wide variety of missions from Alaska's North Slope to the islands of the Caribbean. NOAA scientists and surveyors have used these aircraft to tag polar bears, tow sophisticated sensors, assess oil spill damage, and occasionally operate from NOAA ships at sea.

Much of the scientific instrumentation flown aboard NOAA aircraft is designed, built, assembled, and calibrated by AOC's System Engineering Division. SED engineers and technicians, along with AOC's fabrication specialists, devise airframe modifications to enable the mounting of sensors, cameras, radars, and other specialized equipment. In 1993, Synoptic wind information developed from sondes dropped by NOAA P-3s was instrumental in allowing the National Hurricane Center to predict Hurricane Emily's turn away from the East Coast, saving tens of millions of dollars in preparation costs.

Helping NOAA meet its responsibilities as the Earth Systems Agency while operating safely under some of the world's most demanding flight environments has become the hallmark of the aviation professionals at the Aircraft Operations Center.⚓

GULFSTREAM G-IV SP - N49RF

Crew:	2 Pilots, 2 Observers, 8 Workstations
Cruise Speed:	Mach 0.77 - 0.80
Takeoff Weight:	74,000 lbs
Scientific Payload:	~6,000 lbs
Ceiling:	45,000 FT
Endurance/Range:	9 Hours / 4,075 NM

Instrumentation:

Pressure, temperature, humidity, and navigation sensors; Downward-looking radiometer; GPS dropwindsondes; Flexible data collection system; SATCOM and Flight Phone

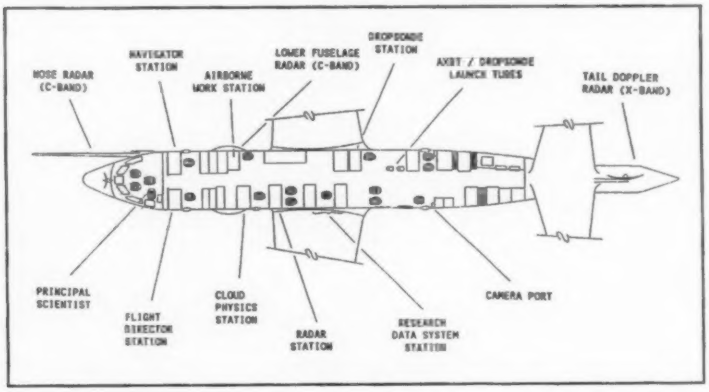
Scheduled for mission use in July '96, the G-IV will provide scientists with an unparalleled platform for the investigation of processes in the upper troposphere. Its combination of range, payload, ceiling, sensors and on-board data collection capabilities will be unmatched. The jet's first mission will be Hurricane Surveillance, providing vastly improved data from soundings around the periphery of hurricanes to computer models that predict storm track. Future missions will include hurricane reconnaissance, weather research, global climate studies, air chemistry, satellite validation, and remote sensor development.

LOCKHEED WP-3D ORIONS - N42RF and N43RF

Flagships of the NOAA aircraft fleet, the P-3's are among the most advanced airborne environmental research platforms flying today. They operate around the world, participating in NOAA, interagency, and international investigations. These aircraft give scientists a unique asset for the study of hurricanes and other severe storms, global climate change, air chemistry and pollution, oceanography, arctic ice formation, and many other environmental issues. Recent projects have included COAST (Northwest Winter Storm Development), VORTEX (Tornado Tracking Project), and OZONE (Air Chemistry/Pollution Evaluation).

Max. Takeoff Weight:	135,000 lbs.
Cruise Speed:	300 kts.
Ceiling:	27,000 ft.
Maximum Range	
Low Altitude:	2,500 NM
High Altitude:	3,800 NM
Maximum Endurance:	12 hrs.
Years Built:	1975 / 1976

Scientific Complement: Up to 12 Project Personnel



ON-BOARD INSTRUMENTATION

- C-Band Lower Fuselage Radar
- X-Band Doppler Radar (Tail)
- Expendable Bathythermograph
- Static and Dynamic Pressures
- Horizontal and Vertical Winds
- Atmospheric Electrification
- Sea Surface Temp Radiometer
- Stepped Frequency Microwave Radiometer
- Dropwindsonde Profiling
- Cloud Physics System
- Cloud Particle Probes
- Aerosol Sampling System
- Pyranometers
- Pyrgeometers
- Ambient/Dewpoint Temp.
- Radiation Sensors
- Photography Ports
- Aircraft/Satellite Data Transmission Link
- Navigation Systems: Inertial, GPS, Loran C

The Sinking of The Titanic

Derek Schmeling
Lenexa, Kansas

Derek is a 7th grade student at the Bonjour Elementary School in Lenexa, Kansas. His teacher is Mr. Newell.

Introduction

In 1898, a writer named Morgan Robertson wrote a novel titled Futility. It was about a great ocean liner, "The Titan," that sank after it collided with an iceberg in the North Atlantic. Fourteen years later a ship almost identical to the one in the book sank after hitting an iceberg in the North Atlantic. The ship was called the *Titanic*.

The Idea

In 1907 two men, J. Bruce Ismay, president of the White Star Line, and Lord Pirrie, Chairman of Harland and Wolff Shipbuilders, started making plans for three ships at a London dinner party. They wanted to build three great ocean liners that would be large, comfortable, and luxurious. Of the three ships, *Olympic, Titanic*, and *Britannic*, the *Titanic* would be the biggest and most luxurious.

Construction

The *Titanic*'s keel was laid in 1908. It took about 50,000 men to build the ship. It was 882.5 feet long, its maximum beam was 92.5 feet, and it was 11 stories high. If stood upright, it would have been taller than any building of its time. With the exception of its sister ship *Olympia*, which was the first of the three ships to be built, it was 50 percent longer than any other ship afloat at that time. Without people, luggage, and freight, it weighed 46,328 gross tons. It had nine decks, a grand staircase 60 feet high, and three anchors (weighing a total of 31 tons). During construction, it took 10-20 horses (accounts vary) to pull just one of the anchors to the *Titanic*.

Launching and Finishing

On May 31, 1911, the hull of the *Titanic* was launched at Harland and Wolff Shipyards in Belfast, Ireland. Twenty-two tons of soap, grease, and train oil was smeared on the rails of the launching ramp to get the *Titanic* into the water. An eyewitness at the launching said the ship had, "a rudder as big as an elm tree…propellers as big as a windmill. Everything was on a nightmare scale."[1]

For the next 10 months, finishing touches were put on the *Titanic*. When it was done, it was definitely a "floating palace." Some first class rooms had fireplaces. Also available to first class

Continued on Page 27

The Sinking of the Titanic

Continued from Page 26

passengers were: a Turkish bath, a squash court, a gymnasium, a swimming pool, a writing room, a restaurant, and a smoking room.

Power and Speed

Besides being luxurious, the *Titanic* had power—and lots of it. The engines produced about 50,000 horsepower giving the ship a top speed of 24 to 25 knots. Each engine was protected by a bulkhead. The engines were powered by 29 boilers. The ship needed three smokestacks but, at Lord Pirrie's insistence, a fourth smokestack (the rear one) was added to make the ship look more powerful. It was also used as a huge vent. Each smokestack was big enough for two locomotives to drive through at once. The smokestacks were slanted to make the ship look faster.

The engines also powered 50 onboard telephone conversations, the wireless (radio) telegraph, four elevators, a gymnasium with electrical gadgets, heating, refrigeration, cranes, pumps, winches, and a kitchen with appliances not found in ordinary homes.

Unsinkable Features

The hull of most ships at the time were usually one big compartment, but the *Titanic*'s hull consisted of sixteen separate compartments described as "watertight," although there were no tops to these compartments. In an emergency, a switch could close watertight doors between the compartments. The *Titanic* was designed to stay afloat if either the front four or the rear four compartments filled with water, but if any more would fill, it would sink. Lloyd's of London insured the *Titanic* and said the chance of its sinking was one in a million. Some people didn't agree.

Besides "unsinkable," the *Titanic* was described as, "The Millionaires' Special," "The Wonder Ship," "The Unsinkable Ship," and "The Last Word in Luxury."

The Beginning of the Maiden Voyage

April 10, 1912, was the beginning of the *Titanic*'s maiden voyage. The captain would be Edward J. Smith, who had 38 years of experience and, at the age of 59, was going to retire soon. Six months before, Captain Smith was commander of the *Titanic*'s sister ship *Olympic,* when it collided with a cruiser, the *H.M.S. Hawke*. The *Olympic*'s hull was badly damaged.

The *Titanic* began its maiden voyage from Southampton, England. There were many famous first class passengers aboard the ship. The wealthiest was Colonel John Jacob Astor, who owned several New York hotels. J. Bruce Ismay, president of the White Star Line, and Thomas Andrews, the *Titanic*'s main designer, were also aboard. From 9:30 to 11:30 am passengers boarded the ship. At noon the *Titanic* cast off.

The *Titanic* made its first stop in Cherbourg, France, at 6:30 pm that same day. At 8:10 pm it left Cherbourg and arrived at Queenstown, Ireland, early on April 11th. At 1:30 pm that day it left Queenstown headed for New York. On board were 2,227 people: 907 crew members and 1,320 passengers. There were 337 passengers in first class, 271 in second, and 712 in third. There were 3,435 mailbags, about 6,000 tons of coal, and 900 tons of baggage and freight.

April 12th and 13th passengers aboard the *Titanic* enjoyed the relaxing voyage. Every once in a while the ship's two radiotelegraph operators received iceberg sightings from other ships, which were relayed to the crew. Due to the unusually warm weather in Greenland, there were more icebergs in the area than usual, and they were also drifting farther south than usual.

The Sinking

On the evening of April 14, 1912, the *Titanic* was moving around 22 knots. It was a clear and moonless night with light winds and a calm sea. One of the crewman stated later that it was the smoothest sea he'd ever seen in that area of the Atlantic. The air was getting colder. Frederick Fleet and Reginald Lee, the ship's lookouts in the crow's nest, especially

Continued on Page 28

The Sinking of the Titanic

Continued from Page 27

noticed the change in temperature. Earlier that day the *Titanic's* radiotelegraph operators received about six sightings of icebergs, so Captain Smith ordered two lookouts instead of the usual one. But the ship sped on. "Even God himself couldn't sink this ship," said one of the crew members.[2]

The two radio telegraph operators, Jack Phillips and Harold Bride, had been working 24 hours a day. About 11 pm Bride laid down for a nap as Phillips began his shift operating the radio. As Phillips was sending messages, he began to receive an ice sighting from the *Californian,* which had stopped because of the ice. The radio signal was so strong it blasted in Phillips' ears. Phillips cut into the *Californian*'s message and replied with "Shut up, shut up, I'm busy!" The *Californian*'s message was never delivered to the bridge.

In the crow's nest, Frederick Fleet was covered in blankets and desperate to get out of the cold. About 11:39 pm Fleet saw a black object blocking the stars light directly in the Titanic's path. Fleet immediately rang the alarm bell three times, the signal for danger, and picked up the telephone that connected the crow's nest with the bridge. "Iceberg right ahead!" Fleet yelled. The warning was relayed to First Officer William Murdoch who was on the bridge at the time. "Hard a' starboard!" he ordered, followed shortly by the another order to reverse the engines. Murdoch also pulled the switch to close the doors of the watertight compartments. It was about 37 seconds before the ship began to turn.

The *Titanic*'s crew tried to avoid the iceberg, but the warning came too late. The iceberg scraped along the forward third of the starboard side of the *Titanic* separating the inch-thick steel plates of the hull. Five of the "watertight" compartments began to take on water. Most of the people were asleep, or inside from the cold. Of the passengers that were awake, most either didn't notice, or didn't know what the "shudder" was. A passenger named Jack Thayer said "If I had a brimfull of glass of water in my hand, not a drop would have been spilled." Even after people learned the ship hit an iceberg, there was little concern—after all, it was "unsinkable." Some people that had come out on the decks to find out what had happened started making snowballs and playing soccer with the pieces of ice that had showered onto the starboard decks.

The collision seemed subtle, but the damage was severe.

Twenty minutes after the collision, Captain Smith and Thomas Andrews, the ships main designer, inspected the damage. Andrews saw water entering five of the "watertight" compartments—one more than it was designed for. Andrews said that the forward 5 of the 16 compartments were filling with water, and would pull the bow of the ship downward. Since there were no tops to the "watertight" compartments, as the bow lowers, the water would fill up one compartment and spill over to the next, and the next, and the next (similar to an ice cube tray). Andrews figured the ship had an hour and a half before it sank.

Captain Smith ran to the radio room and ordered Phillips to send a "CQD"—the distress call. Five minutes later Bride nudged Phillips and said "Send SOS—it's the new call, and it may be your last chance to send it." This was probably the first time the letters SOS were used in an actual emergency. (Phillips did not survive the disaster.)

The *Carpathia*, about 48 to 58 miles away, was the closest ship that heard the distress calls. It immediately headed for the *Titanic*'s telegraphed position. Meanwhile, Captain Smith noticed the lights of a ship about 10 to 20 miles away and ordered flares fired to attract its attention. The ship he saw was the *Californian.* The officers aboard the *Californian* saw the flares and knew the ship was the *Titanic,* but thought the flares were meant to either signal another ship of the White Star Line or as fireworks display for the passengers (both practices were not unusual at that time). The *Californian*'s radio operator shut down his radio shortly after being "cut off" by the *Titanic*'s radio operator, so the *Californian* could not receive the *Titanic*'s distress calls.

Captain Smith ordered his officers to begin loading the lifeboats with

Continued on Page 29

The Sinking of the Titanic

Continued from Page 28

the order, "Woman and children first." Smith knew there were only enough lifeboats for about a third of the people on board. About 45 minutes after midnight, on April 15, the first lifeboat was lowered. It had only 28 people on board. The first lifeboats to lower were only about half full.

There was one officer in charge of loading lifeboats on each side of the ship. Captain Smith's order, "Women and children first" was interpreted differently by each of these officers. One thought the Captain meant women and children ONLY and allowed only women and children in the lifeboats, even though that meant some of the lifeboats were only half full. The other officer thought the Captain meant women and children first, and THEN men if there was room in the boat. (At first, officers had trouble filling lifeboats—many passengers did not realize the danger and were reluctant to leave the "safety" of the large ship for a small lifeboat.)

Third class passengers had a hard time getting to the upper decks. They had to bust through doors that were normally locked to separate the third class passengers from the second and first class passengers. Some third class passengers who broke locks were threatened by crewmen who said the White Star Line would prosecute them for damaging property. Almost half the men in first and second class got on lifeboats. Only a few women in third class got on lifeboats.

Harold Bride and Jack Phillips were in the radio room when, according to Harold Bride (who managed to survive the disaster by riding on a lifeboat that had gone into the water upside down), Captain Smith told them, "Men, you have done your duty. You can do no more. Abandon your cabin. Now it's every man for himself." However, Phillips kept working the radio until the power went out. While the ship was sinking, the 8-man orchestra had been playing ragtime music to keep spirits up. Now the orchestra played its final song, either "Nearer my God to thee" or "Autumn"—different people remembered different things about the sinking. None of the members of the orchestra survived the disaster. Thomas Andrews was last seen in the first class salon staring blankly ahead.

By 2:05 am all the lifeboats had been lowered. One of the last slid off the deck upside down as the *Titanic* sunk under it.

The ship sank around 2:20 am with loud hissing (from the boilers). About 1,500 people were either aboard or in the water.

In the Lifeboats

In the lifeboats some people were in their best clothes, some in pajamas. The temperature of the air was around freezing, and most people were not dressed for the cold.

Altogether, there were 20 lifeboats—including the one upside down. Fifth Officer Lowe was in charge of lifeboat number 14, which was the only life boat that went back to rescue swimmers. Officer Lowe purposely waited before he went back because he was afraid the people in the water would swamp the lifeboat. But he waited too long. The temperature of the water was around 38 degrees. At that temperature, a person in the water does not live long. Only four swimmers were rescued by boat 14. One of them died about an hour later.

Third officer Pittman was in lifeboat number 5. He claimed he wanted to go back to rescue some swimmers, but the people in the lifeboat were against it. Boat number 5 did not go back. The other lifeboats did not go back to rescue swimmers because they were afraid their lifeboat would be swamped.

The people in the lifeboats did not bring much with them, but they made the most of what they had. Edith Russell amused a baby with a toy pig that played "Maxixe" when its tail was cranked. Steward Ray had six handkerchiefs. He made each one into a cap and gave them to the coldest people in the lifeboat. A sailor even gave his stockings to Mrs. Washington Dodge. He told her, "I assure you ma'am, they are perfectly clean. I just put them on this morning."

It was now almost 4 am. Nearing the lifeboats, the *Carpathia*'s

Continued on Page 30

The Sinking of the Titanic

Continued from Page 29

captain, Arthur Ruston, ordered flares shot. When the people in the lifeboats saw them, they screamed and yelled. One lady set her hat on fire, hoping the crew would see the flames. The ship saw them. It took about four hours for the *Carpathia* to pick up 705 people.

Findings and Recommendations

As with all disasters, there are many "Ifs." There would have been no *Titanic* disaster if:

- The captain had reacted to the iceberg messages and decreased speed.
- There was a moon.
- The seas were rougher.
- The lookouts had seen the iceberg sooner—or later.
- The *Titanic* had hit the iceberg any other way.
- The height of the watertight compartments had been one deck higher.
- The *Californian* heard the distress call or responded to the flares.
- The *Titanic* had carried more life boats.

Investigations were held in both England and the U.S. to find out what went wrong. Laws made based on the *Titanic* disaster included:

- A ship had to have enough lifeboats to carry all passengers.
- Ship telegraphs must operate 24 hours a day.
- Agencies were set up to watch icebergs.

Epilogue

New information is still being discovered about the *Titanic*. For example, recent investigation of the wreckage indicates that the total area of the water leakage was only 12 square feet. Also, tests have been conducted on a small piece of the hull plating that was recovered from the wreck site. It was found that the plating was made from "brittle" steel.

Notes

[1] Ballad, Robert, "A Long Last Look at The Titanic", National Geographic, December 1986, p. 698.

[2] Lord, Walter, A Night To Remember, Bantam Books, New York, 1997, p. 42.

Bibliography

Ballad, Robert D., "Epilogue for Titanic", National Geographic, October 1987, p. 454.

Ballad, Robert D., Exploring the Titanic, Madison, Toronto, Canada, 1988.

Ballad, Robert D., "How We Found the Titanic", National Geographic, December 1985, p. 696.

Ballad, Robert D., "A Long Last Look at the Titanic", National Geographic, December 1986, p. 698.

Dudman, John, The Sinking of the Titanic, Bookwright Press, New York, 1988.

Kent, Debra, The Titanic, Children's Press, Chicago, 1993.

Lord, Walter, A Night to Remember, F.A. Thorp, England, 1976.

Rawlinson, Johnathon, Discovering the "Titanic", Rourke Enterprises, Vero Beach, Florida, 1988.

Secrets of the Titanic, 1986, National Geographic Video.

Sloan, Frank, Titanic, Library of Congress, 1987.

"Titanic Disaster", Microsoft Corporation, 1993, Funk and Wagnall's Corporation.

Titanic, the Nightmare and the Dream, MTM Enterprises, 1986.

"Titanic Suffered Little Damage, Divers Find", New York Times, 1997.

Treasures of the Titanic, 1988, Cabin Fever Ent.

"The 'Unsinkable' Titanic", Compton's Learning Company, 1990, p. 22.

Ocean Currents: Not Really Like Rivers In the Sea

Bruce Parker
National Ocean Service

Bruce Parker is the Chief of the Coast Survey Development Laboratory, National Ocean Service, NOAA.

In the last Physical Oceanography column we looked at *coastal currents*, namely, those currents near the coast and in bays and harbors that are caused predominantly by the tide, the wind, and river flow. When most people think of *currents*, however, they usually mean *ocean currents*, like the Gulf Stream or the Kuroshio, and they probably picture a map of the world (like the one in Figure 1) with arrows depicting long streams of flow around the oceans. And at some point these ocean currents may have been described to them as "*rivers in the sea*."

The analogy between a river and an ocean current might have come from looking at a map like that in Figure 1, perhaps from looking at the Gulf Stream, fastest of all the ocean currents (~5 knots). The Gulf Stream is fairly well defined, with at least one distinct boundary on its western edge, different in color and temperature from the surrounding water, and clearly discernable on satellite images of sea surface temperature or sea surface height. But, except for the Gulf Stream's counterparts in the other ocean basins (i.e., the other *western boundary currents),* no ocean currents really have clearly defined boundaries, nor come close to being as narrow as a river (even the Gulf Stream is much wider than any river). Ocean currents dwarf rivers in the magnitude of the water they transport. The Gulf Stream alone transports a greater volume of water than all the rivers of the world combined, about 90 million cubic meters per second (at a location near Cape Hatteras), and that is less than half of the transport of the Circumpolar Current that flows around Antarctica. More importantly, the physics is completely different. Rivers flow downhill, but, as we shall see below, ocean currents flow *around* a "hill" (a hill of water).

One place where the analogy between rivers and ocean currents does work fairly well, however, is

Continued on Page 32

Ocean Currents

Continued from Page 31

from the standpoint of transportation and trade. Inland ships carrying cargo have always followed the rivers, and ships on the oceans have for centuries tried to follow ocean currents. Back in pre-revolutionary days, American ships sailed to England and back in several days less time than British ships because they had maps of the Gulf Stream made by Benjamin Franklin. Later Matthew Maury and others made maps of ocean currents for the rest of the world and proposed shipping routes to take advantage of them. Now modern vessels can overcome any ocean current, but ship captains still consider currents when planning their routes because of the fuel savings they can achieve by following such a current. Or they may plan to avoid a major current for safety reasons, such as off southeast Africa where the Agulhas Current interacts with storm waves propagating up from Antarctica. This strong current flowing against the waves greatly increases their size, often to 50-100 feet in height (large enough to break a ship). Large warm currents like the Gulf Stream are frequently accompanied by squalls, and when they encounter cold air in northern latitudes thick fog develops. (Ocean currents also have a major impact on climate, both locally and on a global scale. Western Europe has a temperate climate because of the warm waters brought north and east by the Gulf Stream. Ocean currents carry half the excess heat from the equatorial regions of the Earth toward the polar regions.)

The average surface current patterns depicted in Figure 1 show similarities among the major ocean basins (the North Atlantic, the South Atlantic, the North Pacific, the South Pacific, and the Indian Ocean). Each basin has a large gyre, which rotates clockwise in the northern hemisphere or counter-clockwise in the southern hemisphere. In each basin, the fastest, narrowest, and deepest current occurs on the western side.

Continued on Page 33

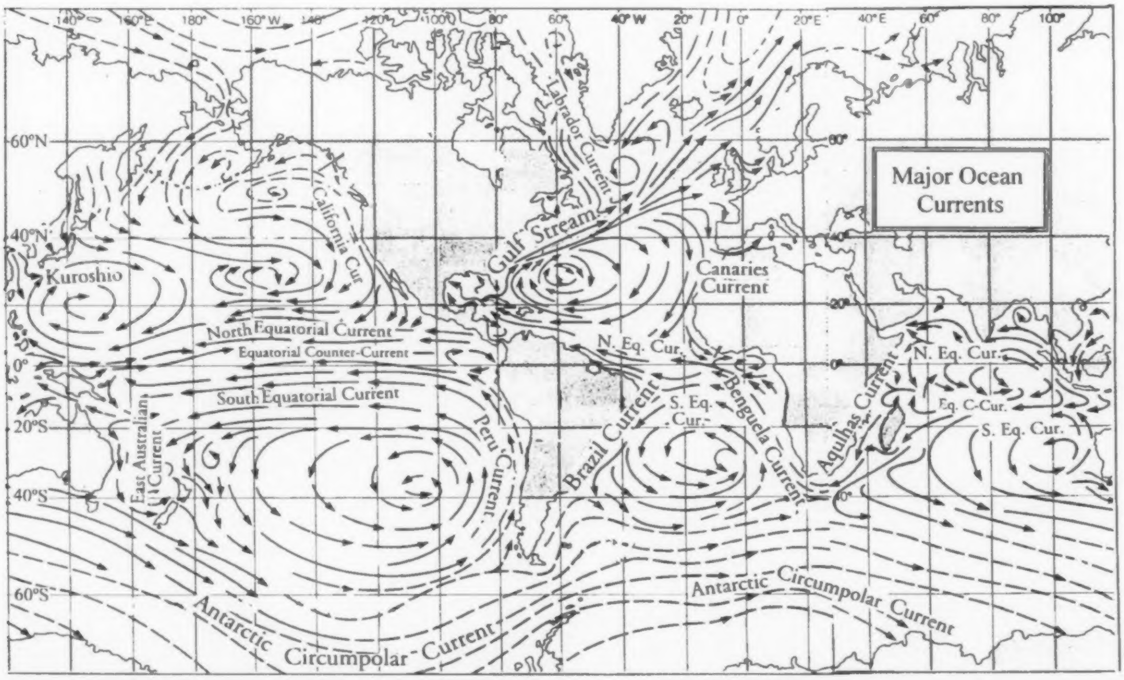


Figure 1. Major ocean currents.

Ocean Currents

Continued from Page 32

These western boundary currents (the Gulf Stream, the Brazil Current, the Kuroshio, the East Australia Current, and the Agulhas Current) carry warm water away from the equator toward the polar regions. On the eastern side of each basin the currents are slower, wider, shallower, and less defined (the Canaries Current, the Benguela Current, the California Current, and the Peru Current [or Humboldt Current]). In the rest of this column we will concentrate on what causes the ocean currents to flow in these patterns.

In a past column we briefly explained about the Coriolis force. Because of its importance with regard to movement of the oceans and the atmosphere, and because it is not really an easy phenomena to visualize for many situations, we will devote a whole column to it next time. For now we will simply say that the Coriolis force isn't really a force; it's the effect of the Earth's rotation on moving objects. When an object (or a parcel of water or air) moves over large distances in a *straight* direction (that is, in a straight direction relative to some absolute reference system, like the stars), the Earth has time to rotate under this motion, so that, when we (standing on that rotating Earth) look at the object's motion, its path appears to curve—to the right if we're in the Northern Hemisphere, or to the left if we're in the Southern Hemisphere. As we shall see, another significant aspect of the Coriolis force is that it is zero on the equator and increases to its maximum effect at the poles.

The primary driving force for ocean circulation is the wind, so we'll first take a brief look at where the global wind patterns come from. The wind patterns shown in Figure 2 are simplified and do not account for the presence of continents. Simply stated, these winds are caused by the unequal heating of the Earth's surface and the redistribution of the excess heat that the tropics receive from the sun to the colder polar regions, on a rotating Earth (i.e., affected by Coriolis force).

The Hadley and Ferrel cells shown in Figure 2 are huge thermally-driven vertical convection cells. Hot air rises over the equator (a low pressure region) and Coriolis force deflects this air flow to the right in the Northern Hemisphere and to the left in the Southern Hemisphere (and thus toward the poles in both cases). By the time this air reaches latitude 30° it has cooled so that it descends to the surface and causes the subtropical high pressure regions. Some of this surface air returns toward the equator and is deflected by the Coriolis force, to the right in the Northern Hemisphere so that the winds blow from the northeast (the *northeast trades*), and to the left in the Southern Hemisphere so that the winds blow from the southeast (the *southeast trades*). The northeast trades converge with the southeast trades along the intertropical convergence zone. Some of the air that descended at 30° latitude moves toward the poles, also deflected by the Coriolis force to produce the *westerlies*. Near 60° latitude this air runs into cold air moving southward from the poles (the polar front low pressure region), and then rises vertically. Some of this air completes the Ferrel cell and some moves toward the pole as part of the polar cell. It eventually descends over the polar high pressure area where at the surface it moves away from the poles, again deflected by the Coriolis force to produce the *polar easterlies*.

When continents are added to this simplified picture, the prevailing winds begin to have a pattern that looks a lot like the pattern of ocean currents shown in Figure 1. Thus, the directions of these winds at the ocean's surface (the easterly trades, the westerlies, and the polar easterlies) do seem to account for the ocean gyres and the direction of the major ocean currents. The easterly trade winds drive the part of each gyre closest to the equator, the westerlies drive the part on the poleward side, and the continents force the currents to bend and close the loop. But it is a little more complicated than that, because there is a mechanism that tends to keep the currents flowing around the gyre, even if the wind stopped. And there is another mechanism that causes the currents on the western side of each ocean basin (like the Gulf Stream) to be faster and narrower than those on the eastern side. In both cases Coriolis plays the major role.

Continued on Page 34

Ocean Currents

Continued from Page 33

When wind blows over the ocean's surface its frictional (rubbing) effect makes the water move, but because of the Coriolis force, this movement is to the right of the wind (in the Northern Hemisphere). For winds blowing steadily for a long time over deep water the surface current direction is approximately 45° to the right of the wind direction. This surface current will drag along the water below, causing a current deeper in the water column which will go a little slower and in a direction a little to the right of the surface current. As we go deeper, the current keeps getting slower and flows in a direction further to the right of the current above it. The entire flow picture is a spiral (the *Ekman spiral*). Averaged over this entire spiral, however, water is transported perpendicular to the wind direction; i.e., 90° to the right of the wind direction (in the Northern Hemisphere). This is usually referred to as *Ekman transport*.

For the clockwise rotating winds over the North Atlantic, for example, transport to the right

Continued on Page 35

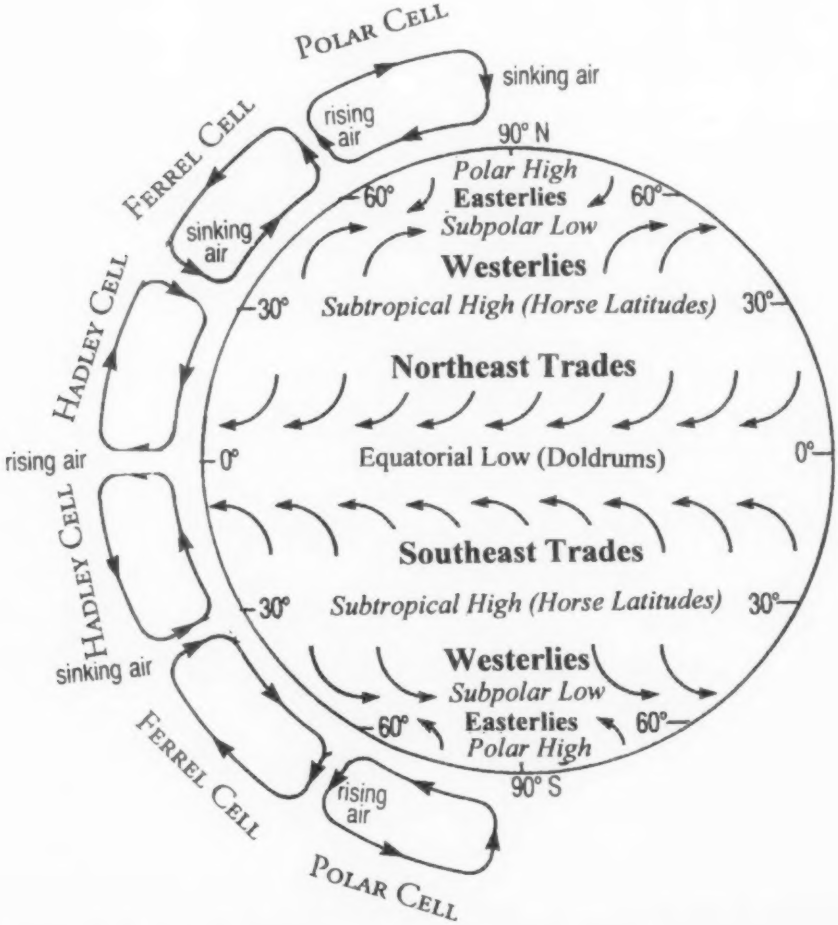


Figure 2. Idealized global wind patterns (ignoring the effect of continents).

Ocean Currents

Continued from Page 34

causes a buildup of water in the center of the gyre, which can be a meter or two higher than at the outer regions. The higher pressure under this "hill of water" causes heavier cooler water to flow out from under the hill, which is replaced by lighter warmer water on top of the hill, until there is no longer a higher pressure under the hill than under the outer regions. However, the hill's surface is still higher (than the outer regions) due to its less dense water. If the winds stopped blowing, and this equilibrium situation started to change, then the currents would slow up, the Ekman transport to the right would decrease, and the water would start flowing down off the "hill." But as this water flowed downhill, it would then be deflected to the right by the Coriolis force, increasing the flow of the currents (and the Ekman transport toward the center), and therefore contributing to maintaining the "hill." Thus the current continues to flow *around* the hill of water along constant height contours. A balance is achieved between the Coriolis force acting on the current, and a horizontal pressure gradient between the lighter (warmer) water on the top of the hill and the heavier (colder) water at the bottom of the hill. This is called a *geostrophic* balance. Although all the major currents in the ocean are generated by the wind, it is this geostrophic balance which allows them to keep flowing at a fairly constant speed even during times when the winds have stopped.

The question still remains, however, why the currents on the western side of an ocean basin (like the Gulf Stream) are narrower, deeper, and faster than currents on the eastern side of the basin. The cause of this "*western intensification*" is the increase in Coriolis force with latitude, which goes from zero at the equator to its full effect at the pole. The tradewind-driven equatorial current part of an ocean gyre is in a region with very weak Coriolis force, so there is not much tendency for the current to turn toward the center of the gyre as it flows westward across the ocean basin. Thus, the current stays fairly well defined and gains momentum, transporting a large volume of water to the point where it is deflected by the continent to begin the western boundary current. The westerlies-driven poleward-half of the gyre, however, flows eastward in a region with a much stronger Coriolis force. There is, therefore, a tendency for the current to turn toward the equator during its entire trip across the basin. It loses water and momentum, so that by the time it reaches the continent on the eastern side there is not much to start the eastern boundary current with, and it stays slow and diffuse as it flows toward the equator.

The Antarctic Circumpolar Current (or West Wind Drift), the largest current in the world (based on volume transport), flows eastward around Antarctica, driven by the westerly winds. Although the current's flow is uninterrupted by continents, it is not particularly fast. This probably is because it extends all the way to the bottom, so that bottom friction slows it down. Bottom topography also seems to have an important influence on it, causing some variability in its path. It tends to move southward (toward Antarctica) as the water deepens and northwards as it gets shallower. It also is in geostrophic balance, but there is no "hill" in the center of a gyre. There is a large change in temperature across the current, with the warmer water (higher elevation) all along its northern edge, and the colder water (lower elevation) along its southern edge.

In this short space we have restricted ourselves to discussing the reasons for the average surface global circulation. These currents, of course, can vary significantly from the average situation described here, on a yearly, seasonal, or even a weekly basis, responding to changing winds and other factors such as water temperature. (Perhaps the most dramatic seasonal effect is seen in the ocean currents in the Indian Ocean due to the monsoon. Winds are northerly from November through March, but southerly from May through September, which causes the Northern Equatorial Current to reverse with the seasons, flowing westward from November through March and eastward the rest of the time.) There is also great variability due to the meandering of ocean currents, and the eddies and rings that are generated by these currents.⚓

November–December 1997

500 mb Height, Anomaly

Sea Level Pressure, Anomaly

The chart on the left shows the seasonal mean 500-mb height contours at 60 m intervals in solid lines, with alternate contours labeled in decameters (dm). Height anomalies are contoured in dashed lines at 30 m intervals. Areas where the mean height anomaly was greater than 30 m above normal have light shading, and areas where the mean height anomaly was more than 30 m below normal have heavy shading

The chart on the right shows the seasonal mean sea level pressure at four mb intervals in solid lines, labeled in mb. Anomalies of SLP are contoured in dashed lines and labeled at 2 mb intervals, with light shading in areas more than two mb above normal, and heavy shading in areas in excess of two mb below normal.

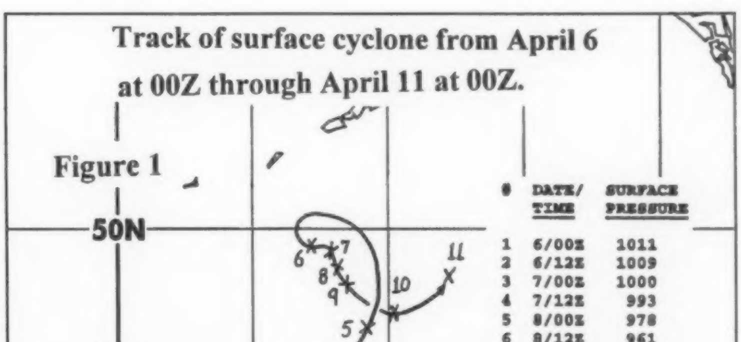
Marine Weather Review
North Pacific Area
April—December 1997

Scott Prosise
NCEP, Marine Prediction Center

April, May, and June 1997

As the seasons change from winter toward the beginning of summer, the number and intensity of storms in the oceans gradually diminishes. During April, there are usually a few last, strong storms before the calmer months of May and June. The year 1997 was no exception, as early April bought another rapidly developing storm to the Pacific.

The storm of April 6 through 11 was noteworthy not only for its late season rapid deepening, but also for its track which took the



Track of surface cyclone from April 6 at 00Z through April 11 at 00Z.

Figure 1

Continued on Page 39

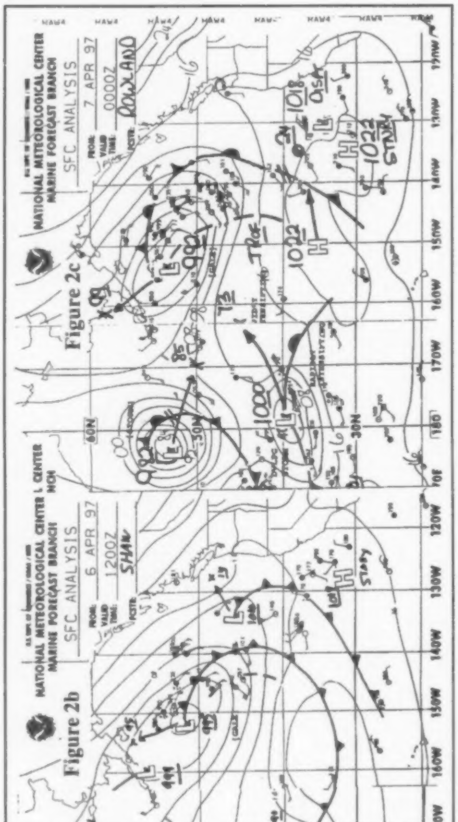


Figure 2a
SFC ANALYSIS 6 APR 97 0000Z
Figure 2b
SFC ANALYSIS 6 APR 97 1200Z
Figure 2c
SFC ANALYSIS 7 APR 97 0000Z

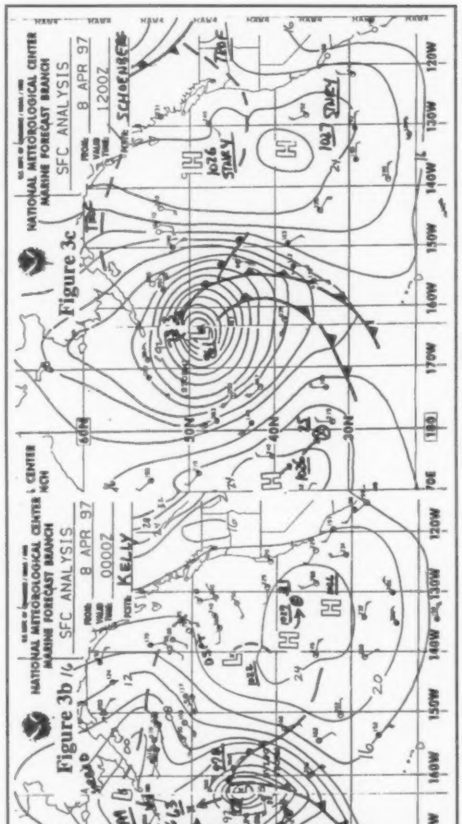


Figure 3a
SFC ANALYSIS 7 APR 97 1200Z
Figure 3b
SFC ANALYSIS 8 APR 97 0000Z
Figure 3c
SFC ANALYSIS 8 APR 97 1200Z

North Pacific Area

Continued from Page 37

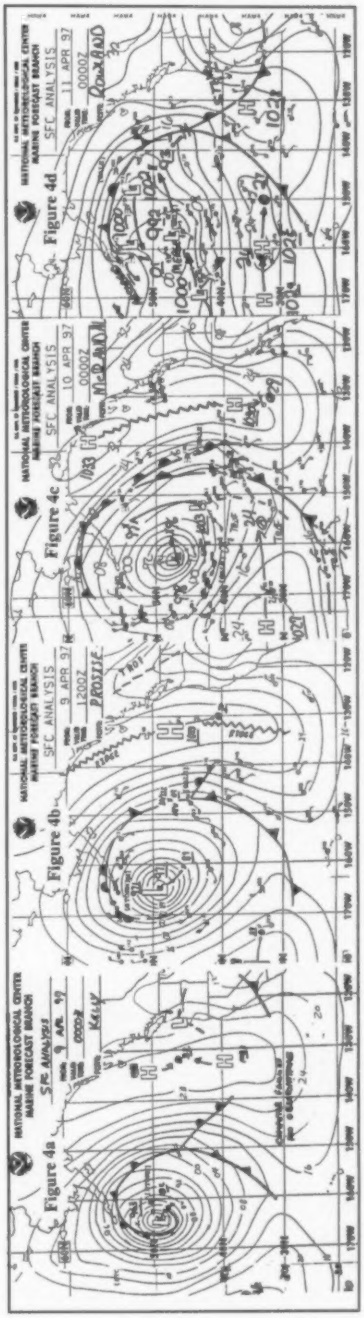
storm northeastward while rapidly deepening, then looping counter-clockwise before finally weakening (Figure 1). The 500 MB charts for this period were not available for this article, but the storm's behavior gives excellent clues as to the structure of the upper atmosphere.

On April 5, a stationary front lied along 40°N west of the international date line. A weak wave developed on this front and moved east to 40°N 177°E by 00Z on the 6th (Figure 2a). Twenty-four hours later, with maximum winds of only 30 kt. and a pressure of 1000 MB, this system began developing into a storm that would soon rapidly intensify (Figure 2c).

At 12Z on April 7 (Figure 3a), the developing storm was accelerating northeastward at 35 kt. An acceleration of a cyclone's forward speed or a fast forward speed is common when cyclones rapidly deepen. At this time, it is likely that a sharp upper trough was approaching the surface low from the W or NW. By 00Z on April 8 (Figure 3b), the low had deepened 15 MB in the past 12 hours and was now moving north, and most likely was located directly under the upper trough. Note the presence of a second cold front to the west with gales observed in the northwest flow of cold air across the dateline. At 12Z on the 8th (Figure 3c), the low was now a fully developed storm with winds to 55 kt. and seas to 35 ft. The colder air to the west of the system was now being drawn into the storm's center. The low had deepened 32 MB in the past twenty-four hours and was down to 961 MB. The movement was now westward suggesting that the surface low had curved west under a closed upper low center.

At 00Z on April 9 (Figure 4a), this mature system now dominates the Central Pacific with gale force winds possible within a 4500-nm area surrounding the storm's center. Maximum winds were 55 kt. with maximum seas of 35 ft. The visible satellite photo of 2332Z April 8 (Figure 5) shows a classic signature for a deep, well-developed cyclone. The center of the low is quite evident. The associated cold front clearly stands out, trailing S then SW. The dappled appearance of the clouds S and SW of the low center is evidence of the cold air being drawn well south of the cyclone. The dark area that spirals into the low center around the south and to the east of the center is the cold air which is now making its way to the center of the system. This is often a sign that the low pressure center has reached maximum intensity, i.e., the system will soon start weakening.

The last three Figures (4b, 4c, and 4d) show the storm's location on April 9 at 12Z, April 10 at 00Z, and April 11 at 00Z. On the 9th, the low began to turn east, with a slightly faster forward speed. During this time, it is likely that the upper low was beginning to "open-up" and move eastward.



Continued on Page 40

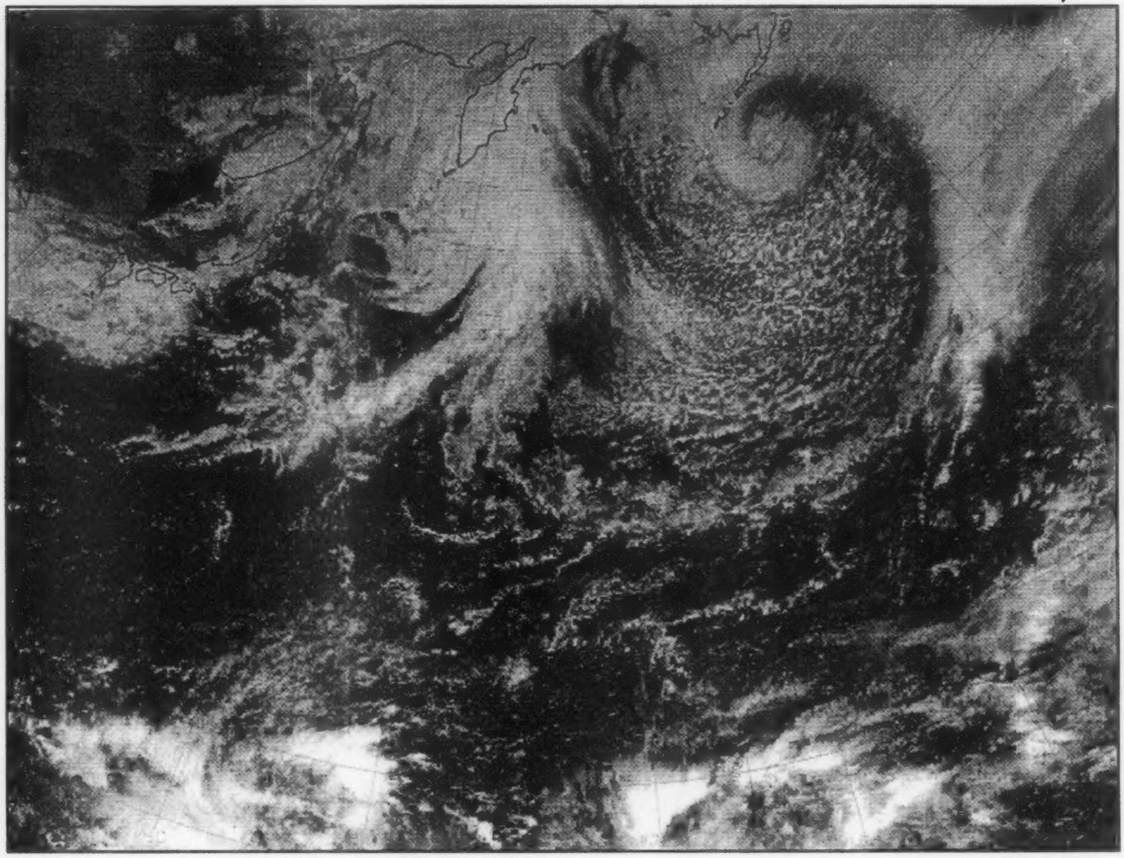


Figure 5. GMS VIS 08 APR 1997 233200

North Pacific Area

Continued from Page 39

The cold air into the system had pushed the cold front 1200 nm well south of the low's center, to below 30°N. The degree of cold air is also evident by the reported rain and snow observed by the ship at 43°N 161°W at 00Z on the 10th. At this time, the maximum winds diminished to 45 kt., decreasing to below storm force for the first time in 48 hours. By 00Z on the 11th, the low had further weakened to a minimal gale. Soon, the low center located west of the system would merge with it as the low further weakened and headed towards the SE Alaskan Peninsula.

July, August, and September 1997

The months of July, August, and September are typically the quietest months in terms of marine weather. During this time, many cyclones never achieve gale strength and only occasionally does one develop into storm strength intensity. However, this period of relative tranquil weather is punctuated by tropical activity. Many tropical systems remain in the tropics, making landfall or dissipating, but several storms turn north and move into the higher latitudes. Some dissipate over the colder waters as they move north, but others make the progression from tropical to extratropical: it is some of these systems that make for some ferocious cyclones over the marine area. The computer models have a difficult time handling this transition, due to the

Continued on Page 41

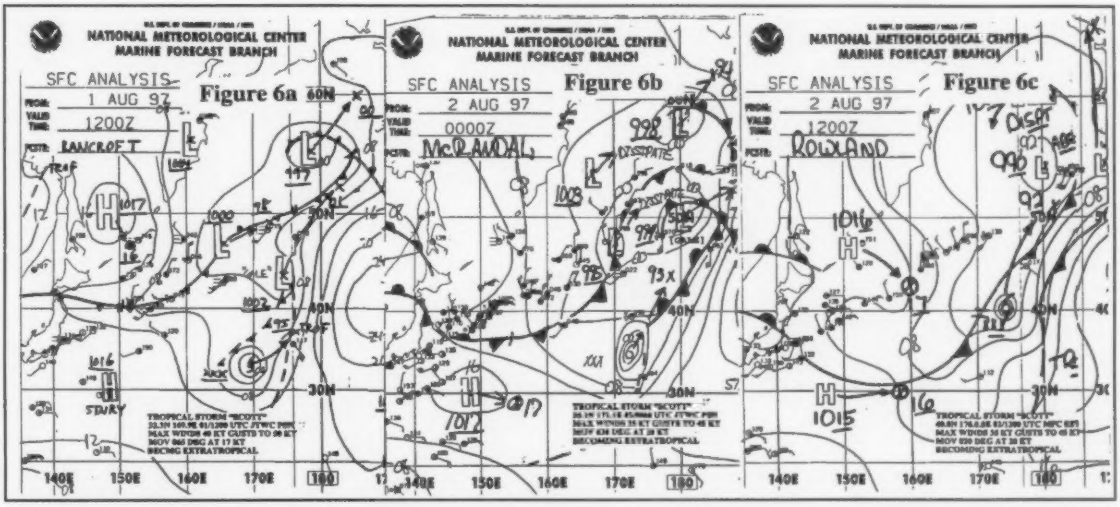


Figure 6a Figure 6b Figure 6c

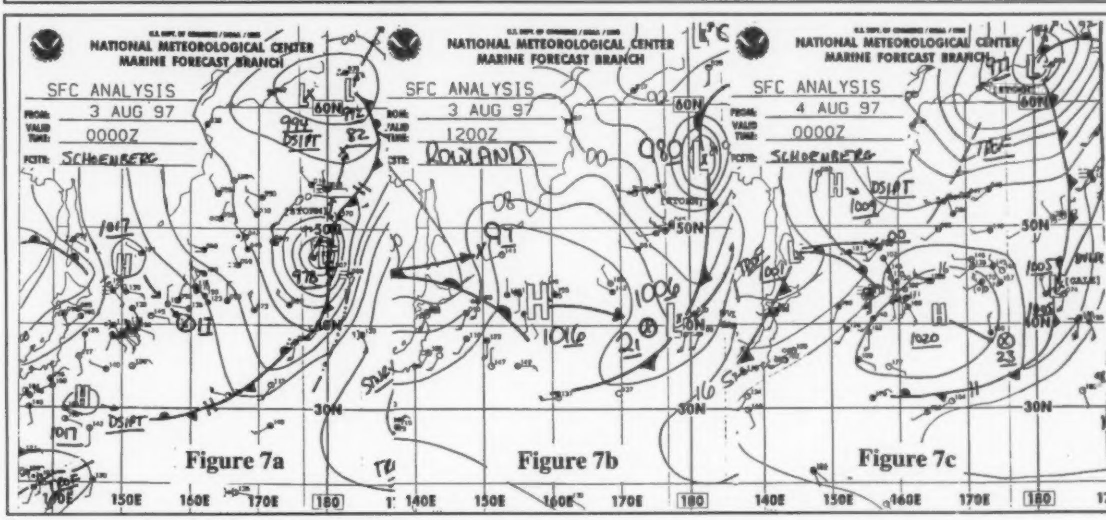


Figure 7a Figure 7b Figure 7c

North Pacific Area

Continued from Page 40

different physics involved between a tropical and nontropical cyclone. These storms are also some of the most challenging to predict for the marine forecaster as well.

The summer of 1997 was no exception to an occasional tropical system "turning the corner" northward and moving into the major shipping lanes. However, one storm in particular stood out amongst the rest: Tropical Storm "Scott" was one of a few that had weakened to a tropical depression, only to strengthen as it moved north and become extratropical. What really made this system unique was that it ended up in Siberia, one of the last places one would expect to see a system with tropical origins!

At 00Z on August 1, Tropical Depression (T.D.) "Scott" was at 31°N 166°E. Movement was E at 14 kt. with maximum sustained winds of 30 kt. At 06Z, the Joint Typhoon Warning Center (JTWC) upgraded "Scott" to a Tropical Storm (T.S.) with sustained winds of 40 kt. At 12Z (Figure 6a), the T.S. moved to 32°N 170°E with maximum winds remaining at 40 kt. By 18Z, "Scott" was turning

Continued on Page 42

North Pacific Area

Continued from Page 41

NE and beginning the transition into an extratropical cyclone. At 00Z on August 2 (Figure 6b), "Scott", located at 35°N 172°E, was a minimal T.S. with sustained winds of 35 kt. By 12Z on August 2 (Figure 6c), "Scott" was losing most of its tropical characteristics as it moved north of 40°N traveling over increasingly colder waters. Note the cold front approaching from the NW at this time.

At 18Z on August 2, the JTWC classified "Scott" as extratropical. This transition from tropical to extratropical is important concerning who has the responsibility for the storm and the manner in which the storm is analyzed and forecast. The JTWC has responsibility for all tropical systems in the North Pacific west of the date line. They issue warnings every six hours for all tropical storms and typhoons. These same conditions are mirrored in the warnings section of the NWS high seas text forecast when a tropical system affects any waters that the NWS has forecast responsibility. However, once the JTWC declares a system nontropical, the NWS Marine Forecast Branch becomes responsible for the warnings associated with these now extratropical cyclones if they are still in our area of responsibility; i.e., north of 30°N and east of 160°E.

At 00Z on the August 3 (Figure 7a), this system was upgraded to storm with maximum winds of 60 kt., only 5 kt. below hurricane, or typhoon force. Seas were up to 30 ft. The low was centered at 47°N 179°E, and was picked-up by the cold front that was west of the system. The storm was accelerating N at 30 kt. along the front. Although not easily seen on the map, a ship at 46°N 179°W reported winds of 60 kt. Twelve hours later, the storm was racing north along the front at 40 kt. with maximum winds remaining at 60 kt. (Figure 7b).

At 00Z on August 4 (Figure 7c), the storm was at 63°N 179°W, rapidly approaching the coast of Siberia. A few hours later, this extratropical system made landfall along the Chukchi Peninsula in Eastern Siberia, then later moved on into the Arctic Ocean. It's quite probable that the residents of this part of Siberia had never before experienced a cyclone with tropical origins and that very few of these cyclones ever make it to the Arctic ocean.

Figures 3a through 3c depict the 500 MB analysis at 12Z on August 1, 2, and 3 with the corresponding surface location of "Scott" marked on the charts. Nearly all of the tropical systems that recurve north are carried eastward by the prevailing upper winds. This series of 500 MB charts is displayed to show how this tropical system uncharacteristically moved north. From the analysis on August 1, a sharpening trough was swinging down east of Kamchatka and the Kuril Islands. An effect of the trough "digging" southward and sharpening was to make the upper flow ahead (east) of the upper trough southwestward. By 12Z on August 3, the upper trough continues to dig southward while moving east. East of the date line, an upper high remained stationary. As the upper trough continued to move east, the flow ahead of the trough and over the surface cyclone continued to turn more southerly with increased speed. This south to north oriented jet steered the surface low north into Siberia. Figure 8d is the 48-hour 500 MB forecast from 12Z August 1, valid at 12Z on August 3. By comparing Figure 8d with Figure 8c, one can see that the 500 MB forecast well. Looking at this upper atmosphere forecast on August 1, could you have predicted the future track of "Scott"?

As mentioned previously, other tropical systems also moved north and became significant extratropical cyclones. Several were stronger as extratropical systems than they were during the waning stages of being classified as tropical.

In August, three such events occurred. Following "Scott" on August 11 at 18Z, "Guillermo," located at 28°N 144°W and moving westward, was classified as a Tropical Depression. Twelve hours later, "Guillermo" was upgraded to a minimal tropical storm (35 kt.). On August 15 (18Z), "Guillermo" was located at 41°N 160°W, now an extratropical cyclone, but was a storm for marine warning purposes with

Continued on Page 43

North Pacific Area

Continued from Page 42

winds now up to 50 kt. A week later on August 21 (00Z), T.S. "Yule" moved into the forecast waters and proceeded slowly northward while weakening. By 06Z on August 23, "Yule" was becoming extratropical at 42°N 170°E. At 18Z, "Yule" was turned over to the MPC from the JTWC as an extratropical low. At this time, while no longer tropical, surface winds increased to 60 kt. and sustained that intensity for the next 12 hours!

The month of September saw four such systems affect the Pacific. On September 3 at 18Z, Typhoon "Bing" was located SE of Japan moving NE. On September 6 (00Z), "Bing" crossed into the forecast waters at 46°N 160°E with maximum winds of 40 kt. and no longer classified as tropical. Eighteen hours later, the winds increased to storm strength and by 00Z on September 7, winds increased to 60 kt. as ex-"Bing" continued moving across the North Pacific. The next such system to affect the area was former Typhoon "David." "David" was moving into the forecast waters as a T.S. on August 20 (06Z) with maximum winds of 55 kt. Six hours later, "David," now as an extratropical cyclone had winds increase to 60 kt. and by 18Z on September 20, winds further increased to typhoon strength with sustained winds of 65 kt. and seas to 35 ft.! Former "David" continued to move northeast and finally weakened below gale strength in the Gulf of Alaska on August 25. Meanwhile, T.S. "Ella" had weakened into a tropical depression at 00Z on September 24 at 36°N 161°E. At 00Z on September 25, the system was considered no longer extratropical. Six hours afterwards, former "Ella" intensified into a gale at 40°N 173°E and remained a gale for the next 72 hours as the cyclone traveled across the North Pacific. The fourth system was Typhoon "Ginger," which began to affect the western part of the forecast waters by 18Z on September 28. At 12Z on September 30, "Ginger," at 45°N 177°E, while no longer a typhoon, carried typhoon force winds of 65 kt. with 35 ft. seas.

In October, only one tropical system affected the forecast waters with some degree of strength, but what a strong system it was. On October 24 (06Z), former Typhoon John was declared extratropical at 30°N 163°E with sustained winds of 80 kt.!

The bottom line: when the phrase "Last Advisory" appears in a tropical bulletin, do not assume that this system has weakened significantly or dissipated. On the contrary, as pointed out in the preceding nine examples, a system that translates from tropical to nontropical may well be a more dangerous system as an extratropical cyclone. A cyclone is classified as tropical or nontropical based on its physical characteristics and not on sustained surface winds!⚓

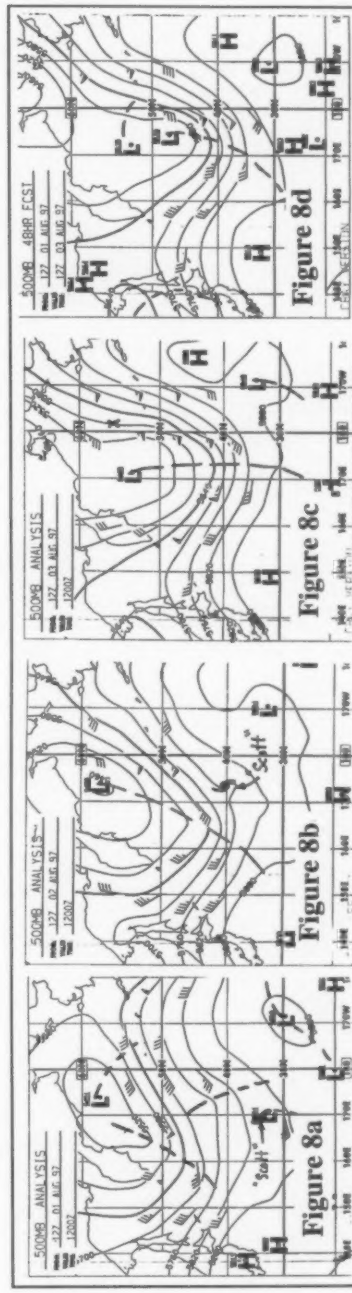


Figure 8a

Figure 8b

Figure 8c

Figure 8d

Marine Weather Review North Atlantic Area April—September 1997

George Bancroft
Marine Forecaster
NCEP, Marine Prediction Center

A slow moving storm moved off the mid-Atlantic coast as April 1997 began. This is the same storm that dumped two feet of snow on Boston on April 1. An infrared satellite picture (Figure 1) shows the storm centered near George's Bank near the time when the winds were strongest. Figure 2 shows the corresponding Marine Prediction Center high seas forecast issued based on data near the time of this satellite image. The high seas text forecast includes the initial conditions which basically have the storm force winds to 55 kt. north, west, and southwest of the center associated with the frontal cloud band. The text contains a second warning paragraph describing higher wind and sea conditions where cold air drawn south on the back side of the storm center encounters the warm Gulf Stream. The resulting instability brings stronger winds aloft to the surface, generating steep breaking waves. A sea state analysis for 1200 UTC April 2 (Figure 3), when the storm center was at 42°N 59°W with 979 MB central pressure, shows a large area of seas 6 meters or higher covering much of the area south, southwest, and west of the center down to 27°N. The storm was most intense at this time, after which the center continued to move northeast and began to weaken.

The late winter-like pattern continued into the last half of April when another low formed near the Bahamas and moved rapidly northeast to George's Bank early on the 19th as a storm before moving east and weakening. This

Continued on Page 46

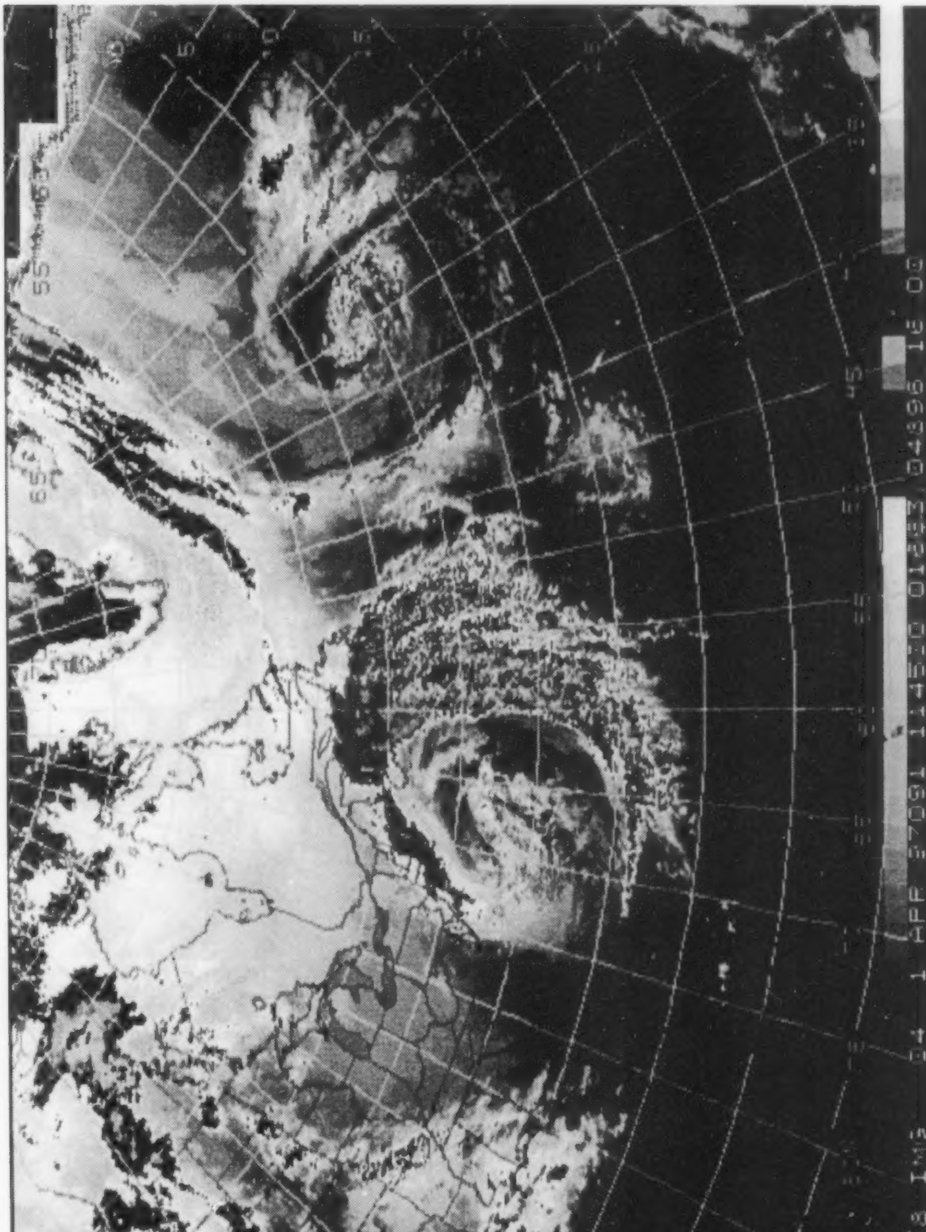


Figure 1. GOES-8 infrared satellite image showing the early April storm at 1145 UTC on April 1, 1997.

North Atlantic Area

Continued from Page 44

system generated wind and sea conditions similar to the earlier storm.

Early June featured an unusual pattern as illustrated in Figure 4 which shows a series of lows moving northeast off the Carolinas, a pattern more typical of mid winter. The most significant of these moved off the South Carolina coast on June 3 and intensified into a strong gale as it moved slowly northeast over the next two days. The last panel of Figure 4 shows the system at maximum intensity centered southeast of George's Bank with several reports on the north and west sides in the 35 to 45 kt. range. The high seas text forecast at the time called for higher winds of storm force 50 kt. and higher sea conditions along the Gulf Stream west of the center. The corresponding sea state analysis (Figure 5) has a maximum of 8 meters just west of the center where the strongest winds are found. The gale center subsequently moved northeast and began to weaken.

July was noteworthy for tropical activity in which four named tropical cyclones (Ana, Bill, Claudette, and Danny)

Continued on Page 47

ZCZC NFDHSFAT1
TTAA00 KNFD DDHHMM

CCODE/1:31:04:01:00/AOW/NWS/CCODE
HIGH SEAS FORECAST
NATIONAL WEATHER SERVICE WASHINGTON DC/TPC MIAMI FL
MARINE PREDICTION CENTER/MFB 1630 UTC APR 01 1997
SUPERSEDED BY NEXT ISSUANCE IN 6 HOURS

SECURITE
NORTH ATLANTIC NORTH OF 32N TO 65N AND WEST OF 35W.
SYNOPSIS VALID 1200 UTC APR 01. FORECAST VALID 0000 UTC APR 3.

WARNINGS

COMPLEX STORM 40N 67W 984 MB MOVING E 15 KT THEN CURVING NE LATE. FRONT EXTENDS FROM SECONDARY CENTER NR 42N 65W TO 40N 60W TO 37N 60W TO 32N 62W. WINDS 40 TO 55 KT SEAS 16 TO 25 FT WITHIN 180 NM N AND W OF A LINE FROM 42N 58W TO 42N 67W TO 39N 70W TO 36N 70W ALSO WITHIN 420 NM W QUADRANT. ELSEWHERE WINDS 25 TO 40 KT SEAS 11 TO 19 FT WITHIN 300 NM E OF FRONT ALSO WITHIN 480 NM N AND W SEMICIRCLES AND FROM 32N TO 38N W OF 66W. FORECAST GALE 46N 57W 983 MB. FORECAST WINDS 30 TO 45 KT SEAS 14 TO 24 FT WITHIN 240 NM N AND W OF A LINE FROM 52N 49W TO 50N 56W TO 48N 59W TO 46N 60W. ELSEWHERE FORECAST WINDS 25 TO 35 KT SEAS 10 TO 18 FT WITHIN 600 NM N QUADRANT AND FROM 32N TO 50N BETWEEN 46W AND 72W.

IN ASSOCIATION WITH COMPLEX STORM NEAR 40N 67W....AREA OF NW WINDS TO 65 KT AND SEAS TO 36 FT WITH BREAKING WAVES ADJACENT TO THE NORTH WALL OF GULF STREAM EXTENDING FROM 33N 77W..35N 75W..37N 72W..38N 70W. FORECAST AREA OF NW WINDS TO 55 KT SEAS TO 32 FT WITH BREAKING WAVES ADJACENT TO THE NORTH WALL OF THE GULF STREAM FROM 37N 72W..38N 70W..38N 65W..38N 60W.

SYNOPSIS AND FORECAST

LOW 48N 47W 1004 MB DRIFTING NE. WINDS 20 TO 30 KT SEAS 07 TO 15 FT WITHIN 300 NM NW SEMICIRCLE AND E QUADRANT ALSO FROM 36N TO 50N BETWEEN 40W AND 44W. FORECAST ABSORBED FORECAST GALE 46N 57W.

AREA OF WINDS 20 TO 30 KT SEAS 08 TO 16 FT BETWEEN 58N AND 62N E OF 45W. FORECAST LOW 64N 48W 1012 MB. FORECAST WINDS TO 25 KT SEAS TO 10 FT N OF 58N E OF 45W

FORECASTER/SHAW/MARINE FORECAST BRANCH

Figure 2. High seas text forecast issued by MPC based on initial data at 1200 UTC April 1, 1997.

North Atlantic Area

Continued from Page 46

passed through MPC's area of responsibility. Of these, only Bill briefly became a hurricane before becoming extratropical near Newfoundland. Later, in mid-September, Hurricane Erika moved north into the waters east of Bermuda on September 10, but was blocked by an upper ridge near Greenland and drifted east as a tropical storm for several days in MPC's southern waters before passing east of 35°W by the 15th. Details and tracks of tropical cyclones may be found in the Tropical Prediction Center column.

In late September activity picked up as the season progressed into fall. One low pressure center intensified north of Newfoundland on the 24th and became a storm as it approached southern Greenland early on the 25th. Figure 6 shows this storm east of Greenland at 0000 UTC 26 September weakening while a new frontal wave was forming off the New England coast. The short wave trough at 500 MB supporting this new development (Figure 6) is south of Nova Scotia and weak initially but is supported by an approaching wind maximum. The shortwave is shown amplifying in the 500 MB charts that follow, until it forms a closed low east of Greenland. The surface low deepened into a storm shortly after the 27/00Z map time and is depicted as a storm affecting the extreme eastern waters at 28/00Z. The 970 MB central pressure at that time drops further during the following 24 hours to the low 950s, with the center becoming nearly vertically stacked just west of Iceland. Note the 55 kt. west wind south of the center at 0000 UTC on the 29th. The storm center started to fill and move east thereafter.

Reference: Joe Sienkiewicz and Lee Chesneau, "Mariner's Guide to the 500-Millibar Chart", *Mariners Weather Log*, Winter 1995.⚓

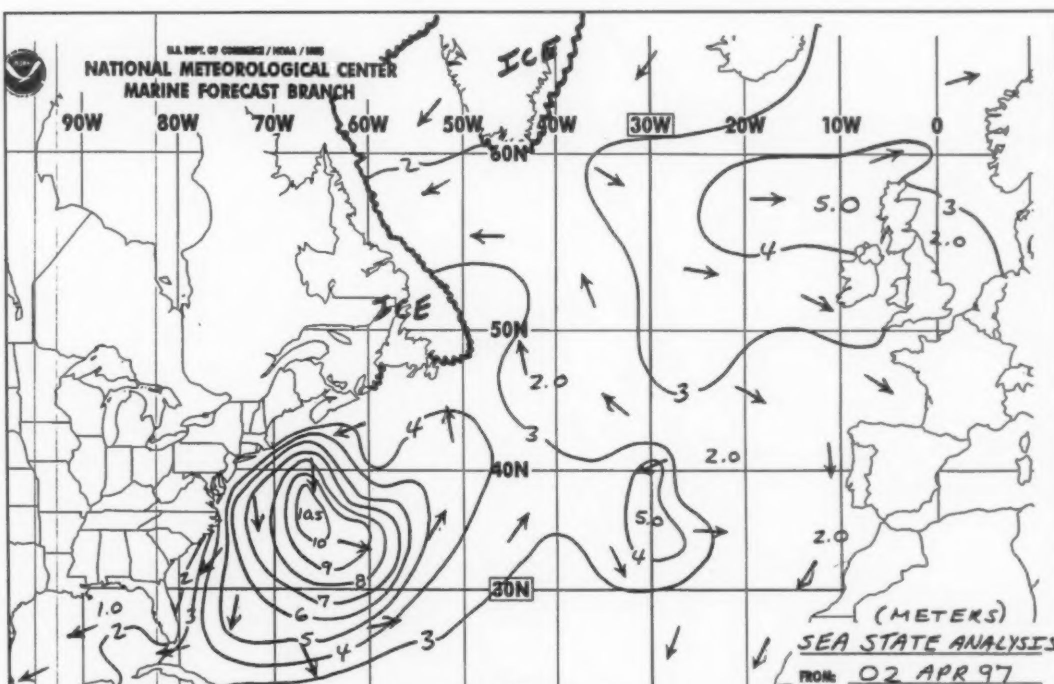


Figure 3. Sea state analysis prepared by MPC valid at 1200 UTC April 2, 1997.

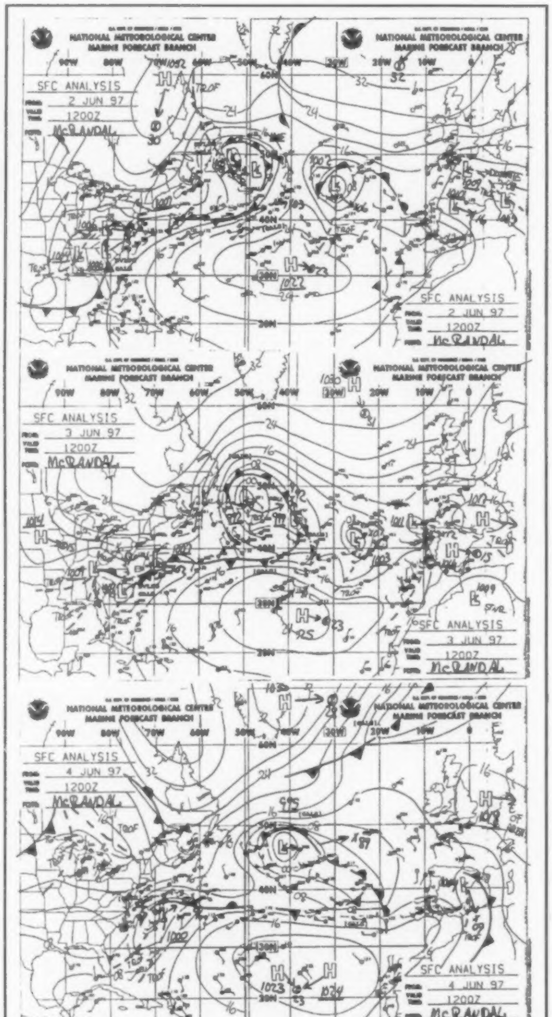


Figure 4. Four-panel chart containing surface analyses showing development of the strong gale off the U.S. east coast early in June 1997.

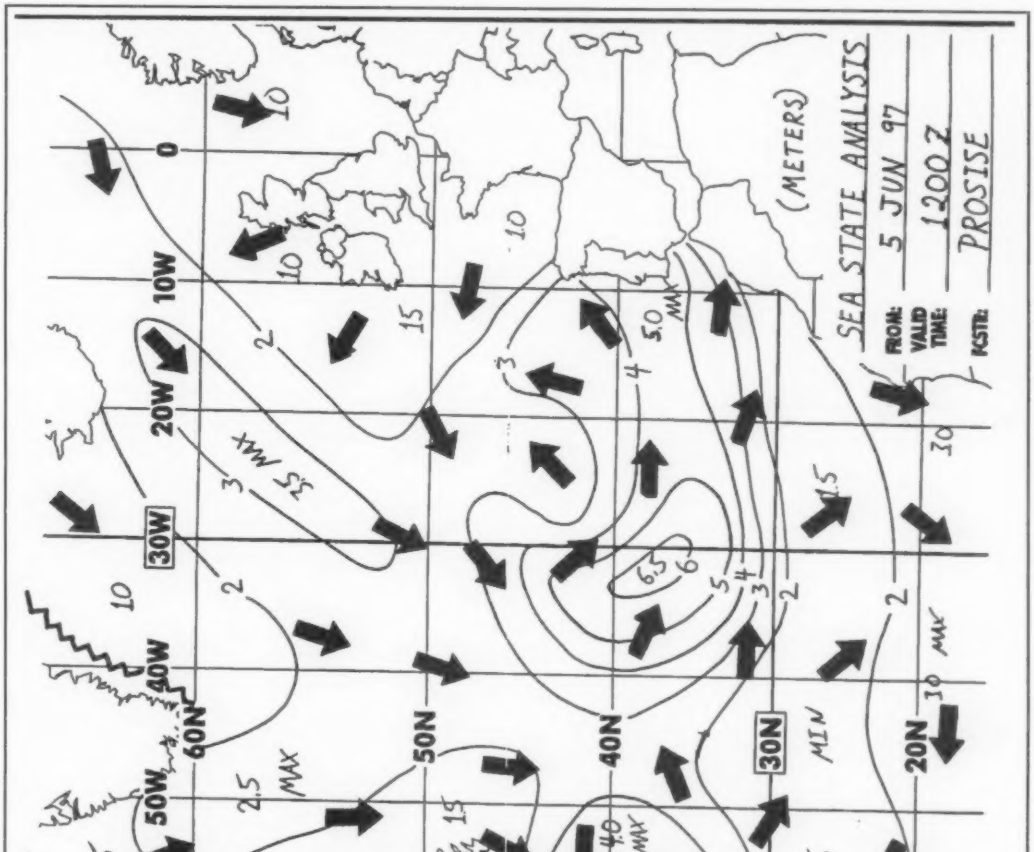


Figure 5. Sea state analysis prepared by MPC and valid at 1200 UTC June 5, 1997, the time of maximum intensity of the gale depicted in Figure 4.

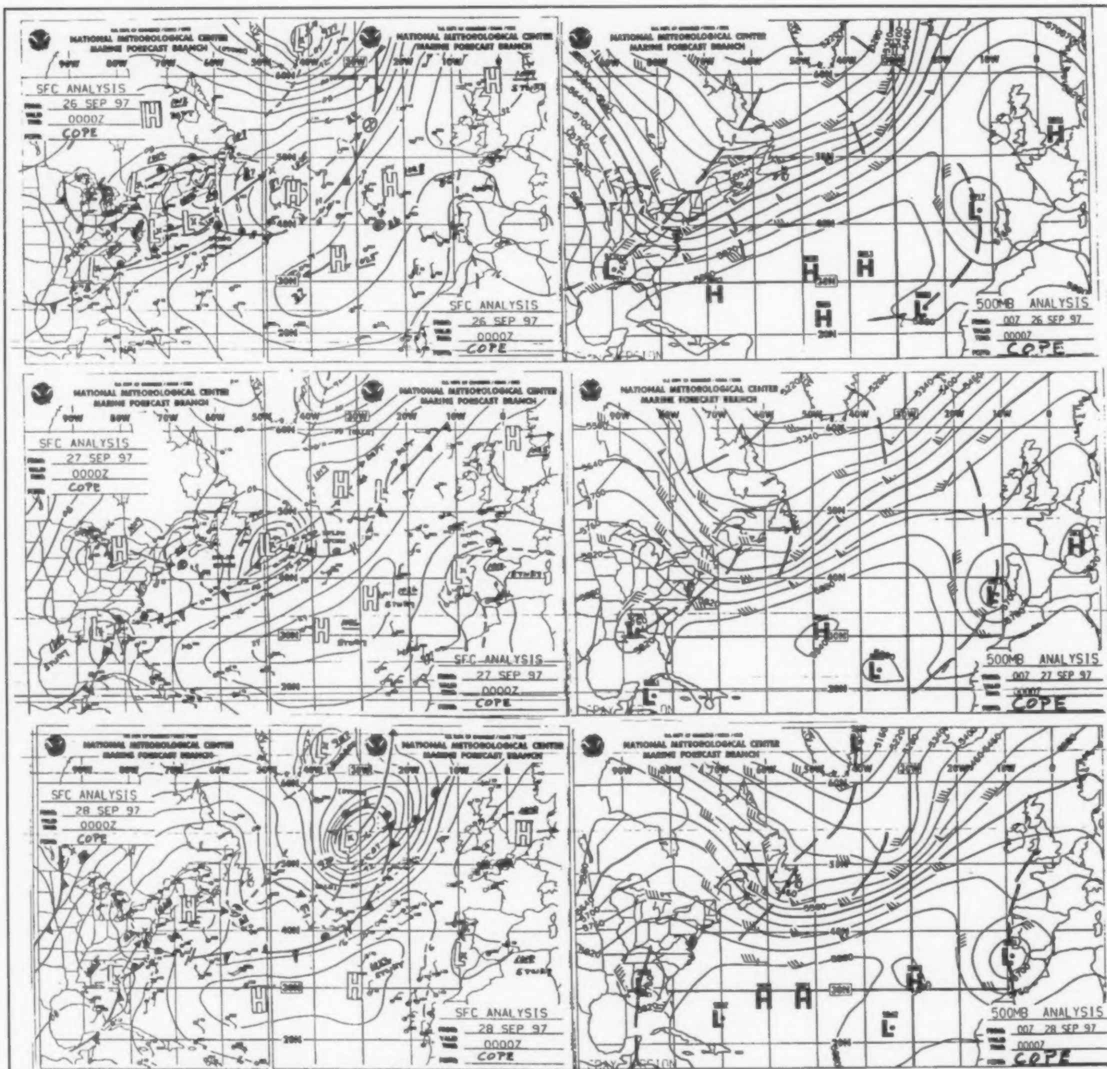


Figure 6. Four-panel chart showing surface analyses and corresponding 500 mb analysis charts for September 26 through 29, 1997, at time 0000 UTC.

Wrecks & Rescues: The History of the U.S. Life Saving Service

From the Gallery Guide of "Wrecks and Rescues: The History of the U.S. Life Saving Service"
Independence Seaport Museum
Philadelphia, Pennsylvania

In the early 19th century the shore was a dangerous and lonely place for sailing ships seeking to reach port. The long approaches to coastal cities such as Philadelphia and New York were poorly marked stretches of sand dunes and salt marshes with few isolated settlements. Unexpected storms with winds blowing from the northeast could suddenly force a ship into sandbars extending from 300 to 800 yards offshore. It might take hours or even days before a stranded ship was discovered. Passengers and crew who tried to swim ashore most often drowned or suffered from extreme effects of exposure to cold water. For those who made it to shore, there was often no place along the desolate coast to go for help.

Coastal communities struggled to assist shipwrecks, but inadequate equipment and a lack of skills limited their rescue attempts. In 1848 and again in 1854, the federal government allocated money to build and equip small "houses of refuge" along the coasts of New Jersey and Long Island, but a more comprehensive rescue was needed.

Designated Superintendent of the U.S. Life Saving Service (USLSS) in 1878, Sumner Kimball created a uniformed service that provided an efficient and comprehensive rescue network. His improvements in conjunction with personnel reforms, which required drills, practice sessions, and planning for the orderly expansion of the service, ensured the long-term success for this organization.

As Superintendent, Kimball also directed the efforts of the USLSS toward research and development of new technologies to solve specific problems that plagued most rescue efforts. The Coston flare, Lyle gun, Francis lifecar, breeches buoy, surfboat, and lifeboat are examples of some of the inventions that were the product of ingenuity and experience. These inventions helped to improve the chances of saving lives from wrecks.

When a surfman discovered a wreck during a routine foot patrol, the entire crew sprung into action, pulling a beach cart full of equipment down the sandy shore, covering a distance of several miles. In addition to rudimentary medical supplies, a typical beach cart may have included Coston flares, lanterns, powder flask, Lyle gun, Hunt gun or other type of rocket and projectile, shot line, faking box with line, hawser cutter, and breeches buoy.

Continued on Page 52

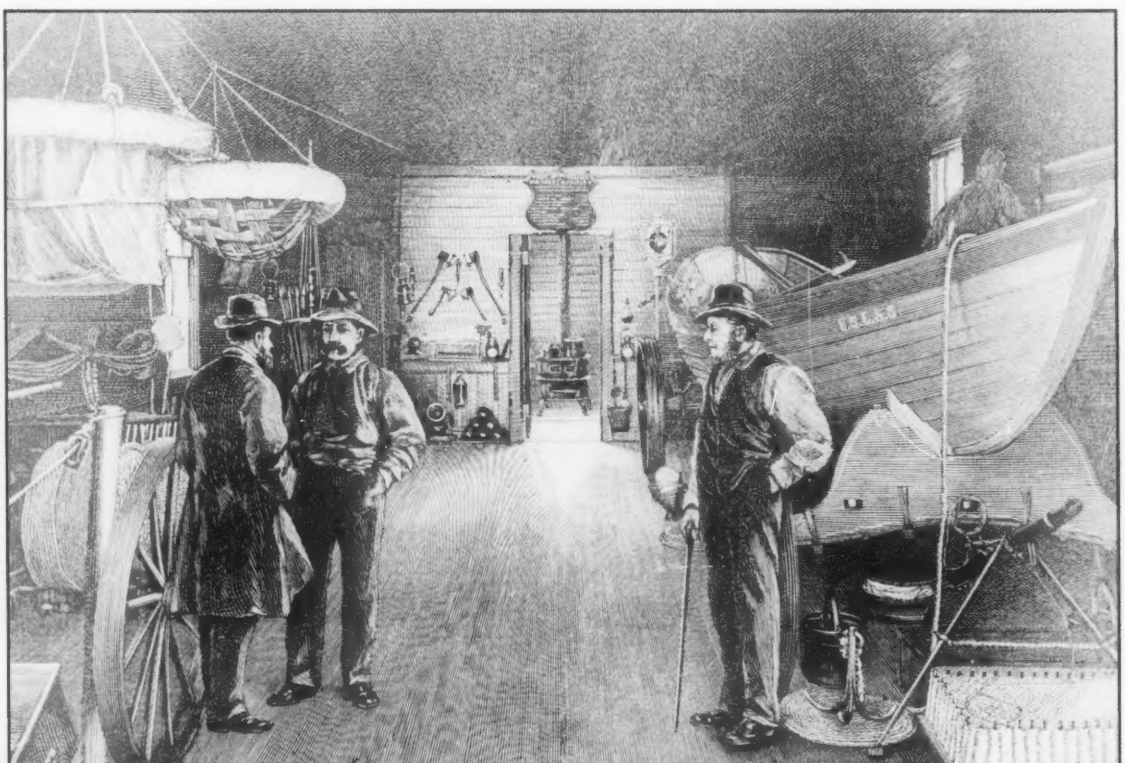
Wrecks & Rescues

Continued from Page 51

In order to ensure long-term Congressional and public support for the USLSS, Sumner Kimball maintained an active and prolific public relations force. *Harpers' Weekly*, *Leslie's Illustrated Newspaper*, *Scientific American*, and other periodicals regularly included feature stories and woodcut illustrations of dramatic wreck and rescue efforts.

From its origins along the Atlantic Coast, the USLSS expanded to the Gulf Coast, Great Lakes, and Pacific Coast, eventually becoming a national network of stations that provided help to distressed ships. New stations, which reflected modern efficiency and design, were built in Victorian architectural styles to complement the new resort buildings and summer houses characteristic of shore communities. Several standard designs were employed across the country, allowing modifications to accommodate local conditions or taste.

By 1915, the successful national service that Sumner Kimball created carefully and methodically over the course of forty years was beginning to dissolve. The USLSS, along with the Revenue Cutter Service and the Lighthouse Service, became the genesis for an entirely new branch of the government—the U.S. Coast Guard. Motor power and improved navigational equipment reduced the risk of shipwrecks as formerly desolate shorelines grew into thriving coastal resort communities. However, the memory and the heroics of the Life Savers of yesterday still echo along the shores of the United States. During its existence, the USLSS aided over 28,000 ships—an incredible record of service and achievement.⚓



"Interior Of A Life-Saving Station" *Harper's Weekly*, March 27, 1886. Woodcut engraving.

The Lights of Puget Sound

Elinor De Wire
Gales Ferry, Connecticut

Puget Sound's reputation for rain and fog is well-known. Travelers complain about it and Seattle-ites joke that they have webbed feet and moss growing on their backs. The region's near-perpetual precipitation is due to cool air rising off the Olympic Mountains that picks up considerable moisture as it funnels its way up through the sound. Light drizzle falls almost daily from October to June, but surprisingly, Seattle's annual average rainfall is less than that of New York, Boston, or Washington, D.C.

Fickle weather and a labyrinth of island-riddled waterways are the reasons Puget Sound has so many lighthouses and fog signals. Many Pacific Coast explorers pass by its opening without ever knowing what lay around its curve, hidden by the interminable mist and murk. It was Capt. George Vancouver who, in 1792, boldly pushed his ship **Discovery** beyond the Strait of Juan de Fuca and christened Puget Sound in honor of his navigator, Lt. Peter Puget.

It would be fifty years before settlers came to the area. The site of their new home was Alki Point, on the south side of Seattle's Elliott Bay. The name is Chinook for "someday," which rather sums up the dreams pioneers had for a booming commercial port. They plumbed the depths of the bay with horseshoes tied to clothesline and found it deep and protected. In keeping with their business aims, these early settlers put lights in their windows at night to aid the burgeoning trades in fishing, lumbering, and passengers. Twenty years later, the Northern Pacific Railroad connected Seattle to the East, making it the hub of northwestern industry and spurring the need for better navigational aids.

Point Wilson Lighthouse

Those first crude window lamps were replaced by the bright beacons, fog signals, buoys, and radio navigation towers that girdle Puget Sound today. Point Wilson Lighthouse, established in 1879, is the welcome beacon of Puget Sound, marking the last leg of a long and difficult searoad from the open waters of the Pacific to Seattle. It stands at Port Townsend on the Olympic Peninsula where the Strait of Juan de Fuca pours into Admiralty Inlet. Here, the main shipping channel narrows and makes a sharp southward turn into Puget Sound.

Continued on Page 54

The Lights of Puget Sound

Continued from Page 53

Named by Vancouver, Puget Sound is a place of contrasts. Frequent and persistent fogs prompted the Lighthouse Board to install a steam fog whistle in the 1870s, which later was upstaged by a diaphragm horn. But the point also experiences some of Puget Sound's rare clarion days of sun and blue sky, with the fantastic peaks of Mt. Baker and Mt. Rainier visible in the distance. Sitting as it does at the easternmost sweep of the Strait of Juan de Fuca and in the rainshadow of the Olympic Mountains, Point Wilson also lays claim to Puget Sound's record for windy and dry days.

The current 51-foot concrete lighthouse, the tallest on Puget Sound, was built in 1913. A residence and garage are part of the station, along with a radio tower. Even so, mishaps occasionally occur. In April 1921 the passenger liner **Governor** collided with the freighter **Hartland** in a thick fog. Both vessels sank in 240 feet of water and eight men drowned. Lightkeeper William Thomas assisted the survivors, who came ashore at Point Wilson in lifeboats.

Point No Point Lighthouse

About 20 miles farther south is Point No Point Lighthouse at Hansville where salmon is king. People here are largely descendants of Scandinavians who settled the area more than a century ago to lumber and harvest its deep water, which drops to 90 feet only a few steps offshore. The only point of land along the settlement was dubbed Point No Point, for it appears as a point to vessels approaching from the north but not from south.

Continued on Page 55

Point Wilson Lighthouse

The Lights of Puget Sound

Continued from Page 54

A peace treaty ending Indian wars in this region was signed on the point in 1855, and a stone marker near the lighthouse commemorates this event. Fishermen stand waist deep in water just off the north side of the lighthouse to take advantage of the nutrient-rich stir caused by the bottleneck squirt of water through Admiralty Inlet. Seals and otters fish here too, popping up their small, puppy-like heads.

Point No Point Lighthouse is the oldest sentinel on Puget Sound, established in 1879. The white, red-roofed, square tower is flanked on either side by a service entry room and the fog signal house. The first lightkeeper was a dentist from Seattle who arrived for duty before the lighting apparatus was completed. To assist mariners, he hung a small oil lamp in the lantern and spent his evenings protecting its flame from the scurrilous wind, since no glass panes had yet been installed. When his pregnant wife arrived a few months later, a milk cow was delivered by schooner and hoisted onto the point in a canvas sling.

For many years, Point No Point Lighthouse served as the Hansville post office. During the years Coast Guard personnel lived at the station, daily weather reports were radioed to the NOAA office in Seattle and to Boeing Field. The officer on duty in July 1931 reported a rare event for Puget Sound—a lightning strike that hit the tower and cracked the valuable 4th order prism lens.

Alki Point

Farther south, past the busy shipyard at Bremerton, is the little sentinel at Alki Point, where the area's first settlers arrived in 1851. The octagonal, 37-foot concrete lighthouse was built in 1918 following the tragic sinking of the steamer **Dix**, with the loss of many lives. Prior to this, the Lighthouse Service had erected a pole beacon on the side of a barn and paid a local resident $15 a month to tend it each night. Today the lighthouse operates automatically and the handsome keeper's quarters serves as housing for senior Coast Guard personnel.

Mukilteo Lighthouse

Guarding the northeast corner of Puget Sound is Mukilteo Lighthouse, facing Possession Sound and marking the searoad to

Continued on Page 56

Mulkiteo Light

The Lights of Puget Sound

Continued from Page 55

Everett. Its name means "good camping ground," which it certainly was in the heyday of trade between the Chimacum, Skokomish, and Clallam. Local tribes probably kept a bonfire going here when encampments were active. Today, Whidbey Island ferries arrive and depart from Mukilteo.

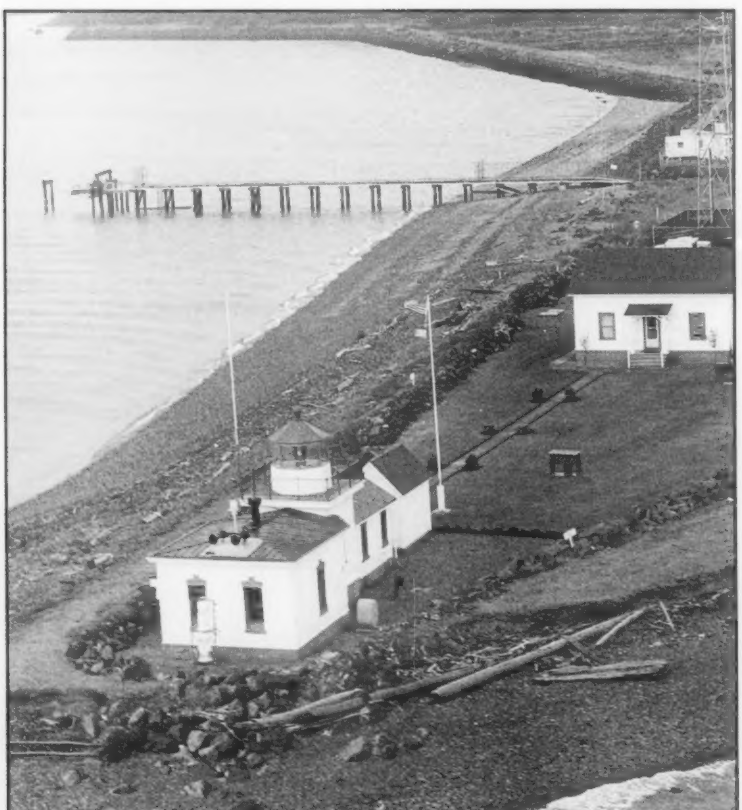
Built in 1906, Mukilteo Light was dubbed the best beacon in the sound in its day. A Daboll fog trumpet jutted form the seaward wall of the lighthouse, and two handsome Victorian homes for the keepers were equipped with state-of-the-art conveniences of the day, including steam heat. In 1927 the old oil lamp was electrified. Today, the lighthouse is automated and a small museum occupies the service house and tower.

West Point Light

Prior to the construction of the 605-foot Space Needle in 1964, West Point Light was Seattle's city beacon. Located in Discovery Park in a pristine area just north of affluent Magnolia Hill, it overlooks the northern entrance to Elliott Bay and sits at the entrance to Shilshole Bay, an artery leading into the Lake Washington Ship Canal with its peculiar floating bridge.

The station is identical in design to Point No Point, with a 23-foot light tower attached to the fog signal building. Built in 1881 for $25,000, it originally consisted of the light tower and a fogbell hung from the lantern deck. By 1888 a steam whistle had replaced the bell, and in 1901 a spacious fog signal house was built to operate a foghorn. Fog cloaks the point an average 350 hours per year.

Erosion has been a problem at the station since its inception. Several storms early in its career washed away beachfront and necessitated construction of a bulkhead. The lighthouse remained attended until 1985. A highlight of its career came in 1981 when the keeper poured champagne on the roof to celebrate the station's centennial.



West Point Light

Point Robinson Lighthouse

Point Robinson Lighthouse on the northeast point of Maury Island guides shipping in and out of Tacoma, south of Seattle. Sailors refer to the point as the "Fog Net," since it is often murky when other areas of the sound are clear. Thus, it's no surprise that Point Robinson began its navigational career with a fog whistle in 1885.

Continued on Page 57

The Lights of Puget Sound

Continued from Page 56

A post light was added a few years later, but it proved ineffective and was replaced by the present lighthouse in 1906, along with a new foghorn.

The bellows for the horn were steam-powered and depended on rainwater caught in a cistern. Some years after the foghorn became the center of a controversy when local residents claimed its frequent din was intolerable and lowered property value. The solution was to make the area a public park.

Brown's Point and Dofflemeyer Point

Deep in Puget Sound's southern extreme are the sentinels at Brown's Point on Commencement Bay, Tacoma; and Dofflemeyer Point on Budd Inlet near Olympia. The light at Brown's Point began as a post beacon in 1887 tended by a local resident. It was upgraded in 1903 to a boxy, two-story tower with a lens and fogbell piggy-backed on its seaward wall. Its first keeper served thirty years and augmented his income by giving piano lessons to local children.

In 1933 the present concrete, square tower was built, along with a new foghorn powered by clock-works that had to be wound up every 45 minutes. The old fogbell was given to a nearby school. After automation, the station was incorporated into a city park.

Dofflemeyer Light also began as a pole beacon and was replaced by a concrete tower in the 1930s. Curiously, the beacon was automated in the 1960s, but the foghorn continued to operate manually until 1987. A local resident named Madeleine Campbell was hired to maintain the foghorn and alert the Coast Guard if the beacon failed. At the time, she was the only civilian woman to work for the Coast Guard as a "lamplighter."

Today, Coast Guard operations for the Puget Sound region are headquartered in Seattle. The buoy tender **Bayberry** maintains hundreds of navigational aids, including the sound's eight lighthouses. A sophisticated network of VTS (Vessel Traffic Service) towers hums a high-tech surveillance of Puget Sound. Monitored from the main Coast Guard pier in Seattle, they track 20,000-plus vessel movements each month, making Puget Sound one of the world's busiest ports and its lighthouses among the most critical.

Photos courtesy of the U.S. Coast Guard.⚓

U.S. Coast Guard buoy tender Fir, which serviced Puget Sound lighthouses, buoys, and fog signals for many years.

UPDATED COMMUNICATIONS METHODS FOR FILING AMVER REPORTS

Communications Method	AMVER's Address	When this method should be used
Electronic Mail via the Internet	62899122@eln.attmail.com	If the ship already has an inexpensive means of sending electronic mail to an Internet address (no more than US$0.01 per character), this is a preferred method. Electronic mail may be sent via satellite or via HF radio, depending on the ship's equipment and arrangements with communications providers ashore. At a minimum, ships must be equipped with a personal computer, an interface between the computer and the ship's communications equipment, and the appropriate software.
AMVER/SEAS	Inmarsat-C via COMSAT	Ships equipped with Inmarsat-C, an IBM-compatible personal computer, an interface between them, and the AMVER/SEAS software (available free of charge from the U. S. National Oceanographic and Atmospheric Administration, NOAA), may send combined AMVER/Weather messages (or either one separately) free of charge via COMSAT Land Earth Stations. This method is highly preferred.
Telex	127594 AMVERNYK	AMVER reports may be filed via Telex using either satellite or HF radio communications methods. Ships or their owners, operators, or managers must pay the tariffs for satellite communications. Radio Telex reports, if filed via a Coast Station participating in the AMVER program, may be sent free of charge. Participating Coast Stations are listed in the AMVER Bulletin. Telex is a preferred method when less costly methods are not available.
CW (Morse Code)	AMVER	This is the least preferred method for filing AMVER reports due to its high cost, potential for error, and the fact that CW usage and the number of Coast Stations supporting it are declining. CW reports may be filed free of charge via Coast Stations participating in the AMVER program. Participating Coast Stations are listed in the AMVER Bulletin.

For more information, contact:

AMVER Maritime Relations Office
USCG Battery Park Building
New York, New York 10004-1499
Phone: (212) 668-7764
Fax: (212) 668-7684
Telex: 127594 AMVER NYK
E-Mail: R.Kenney/amr@internet.uscg.mil

AN AMVER CLIP, POST & SAVE PAGE!

National Weather Service Seeks Cooperation to Safeguard Critical Data Buoys

Michael K. Burdette
Data Systems Division
National Data Buoy Center
Stennis Space Center, Mississippi

The National Weather Service is soliciting the cooperation of the marine community to safeguard offshore automated weather buoys that provide critical information, including wind speed and direction, wave height, pressure changes, and other key data about marine conditions and developing storms along the coast. The data buoys are an integral part of the comprehensive observation system that allows local forecast offices to issue weather warnings and forecasts for the protection of life and property.

"In the past year, six data buoys have been vandalized off the coasts of California, Oregon, Florida, and Hawaii," said Doug Scally of the NWS National Data Buoy Center (NDBC) at the Stennis Space Center in south Mississippi. "These buoys have suffered serious damage that terminated data flow, and often prevent at-sea repairs to restore the stations to full operation. The end result has been a considerable loss of weather observations that are extremely valuable to the marine community."

The buoys which have been damaged are stations 46054 in the Santa Barbara Channel, California; 46050 near Yaquina Bay, Oregon; 46042 near Monterey Bay, California; 46012 near Half Moon Bay, California; 41010 near Cape Canaveral, Florida; and 51001 northwest of Hawaii.

"Because of the importance of the buoys to the marine and coastal communities, we hope to enlist their help in protecting these and similar systems," added Scally.

Specific steps that mariners can take to safeguard the systems include:

- Neither boarding nor tying-up to a data buoy;
- Giving the buoys a wide berth to avoid entangling the buoy's mooring or other equipment suspended from the buoy—500 yards for vessels which are trailing gear and at least 20 yards for all others;
- Reporting to the U.S. Coast Guard any damage you observe to a data buoy;
- Reporting to the U.S. Coast Guard any observation of people on or vessels attached to a weather buoy.

The NDBC operates a network of offshore automated weather buoys and Coastal-Marine Automated Network stations that provide hourly reports of marine weather to NWS and other agencies. The buoys, off the U.S. coasts and the Great Lakes, may be nearby or several hundred miles at sea. These stations provide hourly data to NWS forecast offices that are important to the preparation of forecasts and warnings. These data are also broadcast to the public over NOAA Weather Radio, and are posted on the Internet at **http://www.ndbc.noaa.gov**.

NDBC buoys have either circular or boat-shaped hulls ranging from three meters to 10 meters across, with superstructures extending five meters to 10 meters above the water. All are painted bright colors and imprinted with "NOAA" and the station number, show a yellow, group-flashing-4 (20 seconds) light characteristic, and are identified on applicable navigation charts by the five-digit station number, or as "ODAS."⚓

Voluntary Observing Ship Program

Martin S. Baron
National Weather Service
Silver Spring, Maryland

The VOS Program is On Line

The National Weather Service VOS program now has a presence on the Worldwide Web. The new VOS web page can be found at: **http://www.vos.noaa.gov**. The web site educates visitors on the VOS program, the importance of marine observations, and the services provided by Port Meteorological Officers. (The web site contains a directory of all U.S. PMOs.)

The site has a page for the posting of VOS news and a photo gallery of VOS ships. If you participate in the VOS program and would like to see a picture of your ship posted on the VOS web site, send a picture along with any interesting information about your ship to Bob Webster, PMO, NWS, 501 W. Ocean Blvd., Suite 4480, Long Beach, CA 90802. The site also contains interesting links of special interest to the mariner. Any comments or suggestions about the site should be directed to Bob Webster at the address above or by email (Bob.Webster@noaa.gov).

Vince Zegowitz Participates in Training Cruise

Marine Observations Program Leader Vince Zegowitz participated in the Massachusetts Maritime Academy annual training cruise aboard the **Patriot State** during February 1998. He provided training in weather observing and the ships synoptic code to nearly 400 cadets as part of their studies in Marine Science. This knowledge is required to obtain a 3rd mate license, deck or engine.

PMO Newark Position Vacant Again

The PMO position in Newark, New Jersey has become vacant once again. Jim McClain, who served in the position for about 6 months, has transferred to the National Weather Service Western Region Headquarters in Salt Lake City.

Tim Kenefick, PMO New York, will do his best to service both the New York and New Jersey sides of the vast port of New York/New Jersey, until a replacement for Jim is hired.

Don't Forget to Report Wet Bulb Temperature

Since 1994, wet bulb temperature has been reported in the weather message (as requested by the World Meteorological Organization). Group $8S_wT_bT_bT_b$ occurs after the ice accretion group, in section 2 of the ships synoptic code, and is normally the last group in the weather message unless sea ice is being reported. Air and dew point temperatures are reported in section 1 of the synoptic code, in groups $1S_nTTT$ $2S_nT_dT_dT_d$.

Continued on Page 61

VOS Program

Continued from Page 60

Wet bulb temperature is reported in Celsius degrees and tenths, with the positive or negative sign indicated by S_w. Some examples:

(1) For wet bulb temperature 11.8°, report $8S_wT_bT_bT_b$ as 80118 (S_w is 0 for positive, and $T_bT_bT_b$ is 118).

(2) For wet bulb temperature 4.1°, report $8S_wT_bT_bT_b$ as 80041 (S_w is 0 for positive, and $T_bT_bT_b$ is 041).

(3) For wet bulb temperature -3.6°, report $8S_wT_bT_bT_b$ as 81036 (S_w is 1 for negative, and $T_bT_bT_b$ is 036).

Common Observer Errors

I am including this in the column again to serve as a reminder. Please be especially careful when recording observational data. See the last issue of the MWL (Spring 1997) for more details. Also consult NWS Observing Handbook No. 1, the ship's code card, or your PMO.

The most common errors are:

(1) Mistakes in the reporting of dewpoint temperatures.
(2) Erroneous ship's position information.
(3) Day/time group errors.
(4) Improperly coded visibility.
(5) Errors in the reporting of pressure tendency and characteristic.

Reprint of "Guide To Sea State, Wind, and Clouds"

We are preparing a reprint of the popular "Guide To Sea State, Wind, and Clouds," which should be ready by early March 1998. PMOs will have copies for distribution. The guide contains 14 sea state and 54 cloud photographs. To assist observers the sea state photos are provided with corresponding Beaufort Force and wind speed estimates. The cloud photos are shown with the appropriate ships synoptic code figures.

New Recruits — April through December 1997

During the eight-month period ending December 31, 1997, PMOs recruited 91 vessels as weather observers/reporters in the National Weather Service (NWS) Voluntary Observing Ship (VOS) Program (see listing on page 62). Thank you for joining the program.

Please follow the worldwide weather reporting schedule as best you can—report weather four times daily at 0000, 0600, 1200, and 1800 ZULU or UTC time. The United States and Canada have a 3-hourly weather reporting schedule from coastal waters out 200 miles from shore, and from anywhere on the Great Lakes. From these coastal areas, please report weather at 0000, 0300, 0600, 0900, 1200, 1500, 1800, and 2100 ZULU or UTC, whenever possible.

Coastal Forecast Office News

Toll Free Cell Phone Number For Mariner Reports (MAREPS)

John Lovegrove
Warning Coordination Meteorolgist
NWSO Eureka

Heath Hockenberry, National Weather Service Office (NWSO) Eureka, California, has made arrangements with a cellular telephone company to provide a toll-free emergency cell phone number. United States Cellular customers can dial **#NWS** on their phones and connect to NWS Office Eureka. There is no charge to the caller or NWS.

Mariners are encouraged to use the number to provide Mariner Reports (MAREPS). MAREPS are marine weather reports, usually provided by fisherman or pleasure boaters. NWSO Eureka has both VHF and SSB marine radios, but mariners were reluctant to provide the reports over the airways. When NWSO Eureka makes its twice daily requests for reports on VHF channel 16, mariners can now call in using their cell phones. The NWS receives this important data without the vessel giving away it's location.

NWSO Eureka is hoping to expand this service to all cellular phone customers in the area.⚓

National Weather Service Voluntary Observing Ship Program

New Recruits from July 1 to December 31, 1997

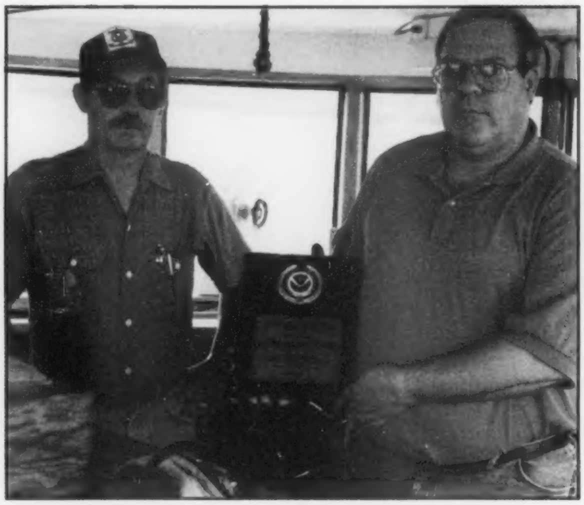
NAME OF SHIP	CALL	AGENT NAME	RECRUITING PMO
AMERICAN MERLIN	WRGY	OSPREY SHIP MANAGEMENT	NORFOLK, VA
ANKERGRACHT	PCQL	KERR NORTON MARINE	BALTIMORE, MD
APL SINGAPORE	WCX8812	AMERICAN PRESIDENT LINES	SEATTLE, WA
ATLANTIC SPIRIT	ELUV4	NISSAN MOTOR CAR CARRIERS	JACKSONVILLE, FL
BRIGHT STATE	DXAC	VICTORIA SHIP MANG. JAPAN	SEATTLE, WA
CANBERRA	GBVC	PRINCESS CRUISES	MIAMI, FL
CAPE HENLOPEN	WM5958	CROSS SOUND FERRY SERVICES	NEW YORK CITY, NY
CAPE KENNEDY	KAOQ	CAPE KENNEDY	NEW ORLEANS, LA
CAPE KNOX	KAOP	CAPE KNOX	NEW ORLEANS, LA
CAPT STEVEN L BENNETT	ELTL6	SEALIFT,INC.	NEW ORLEANS, LA
CHARLES L. BROWN	KNCZ	TRANSOCEANIC CABLE SHIP CO.	JACKSONVILLE, FL
CHO YANG ATLAS	DQVH	REEDEREI F. LAEISZ G.M.B.H.	SEATTLE, WA
CSAV RELONCAVI	DHGE	CSAV SUDAMERICANA DE VAPORES	BALTIMORE, MD
EAGLE BEAUMONT	S6JO	WEAVER MARINE AGENCIES., LTD.	NEW YORK CITY, NY
EAGLE BIRMINGHAM	S6LO	WEAVER MARINE AGENCIES, LTD.	NEW YORK CITY, NY
ELATION	3FOC5	CARNIVAL CRUISE LINE	MIAMI, FL
ELTON HOYT II	WE3993	INTERLAKE STEAMSHIP COMPANY	CLEVELAND, OH
ENCHANTMENT OF THE SEAS	LAXA4	ROYAL CARIBBEAN CRUISE LINE	MIAMI, FL
ENDEAVOR	KUSEND	FARRELL LINES	NEW YORK CITY, NY
ENTERPRISE	KUSXXX	FARRELL LINES, INC	NEW YORK CITY, NY
EQUINOX	DPSC	NORTON LILLY INTERNATIONAL	BALTIMORE, MD
EVER DAINTY	3FMZ7	EVERGREEN AMERICA CORP.	NORFOLK, VA
EVER DECENT	3FUO7	EVERGREEN AMERICA CORP	NEW YORK CITY, NY
EVER GENERAL	BKHY	EVERGREEN MARINE CORP	BALTIMORE, MD
EVER LEVEL	BKHJ	EVERGREEN MARINE CORP. (CA)	MIAMI, FL
EVER UNION	3FFG7	EVERGREEN AMERICA CORP.	SEATTLE, WA
EVER UNIQUE	3FXQ6	EVERGREEN AMERICA CORP.	SEATTLE, WA
EVER UNISON	3FTL6	EVERGREEN MARINE CORP.	LOS ANGELES, CA
GEETA	VRUL7	ANGLO EASTERN SHIP MGMT.,LTD.	NEW ORLEANS, LA
GERLENA	LAXV2	SEABOARD MARINE	MIAMI, FL
GLOBAL FORTUNE	3FZI6	COSMIC MARITIME CORP.	SEATTLE, WA
GOLDEN BELL	3EBK9	KAWASAKI KISEN DAISHA LTD.	SEATTLE, WA
GOLDEN SEA	3FQD3	EUROPEAN NAVIGATION INC.	NORFOLK, VA
GRANDEUR OF THE SEAS	ELTQ9	ROYAL CARIBBEAN CRUISE LINE	MIAMI, FL
HADERA	ELBX4	ZIM ISRAEL NAVIGATION COMPANY	BALTIMORE, MD
HANJIN LOS ANGELES	3FPQ7	HANJIN SHIPPING CO. LTD.	NEWARK, NJ
HOEGH MIRANDA	C6IM7	HOEGH LINES (U.S.) INC.	NORFOLK, VA
JAMAICA PROVIDER	V3NY4	SEABOARD MARINE	MIAMI, FL
JOHN H	WAZ6768	CROSS SOUND FERRY SERVICES,	NEW YORK CITY, NY
KARTERIA	P3TD5	PMO	MIAMI, FL
KEN KOKU	3FMN6	INUI STEAMSHIP CO., LTD	SEATTLE, WA
KIRK CHALLENGER	C6HX5	SEABOARD MARINE	MIAMI, FL
LA ESPERANZA	3EQV8	WILLIAMS, DIMOND & CO.	BALTIMORE, MD
LAUST MAERSK	OXGS2	MAERSK LINE	SEATTLE, WA
LOUIS MAERSK	OXMA2	MAERSK LINE	BALTIMORE, MD
M/V NORDPOL	P3QY5	NORDPOL SHIPPING CO LTD	NORFOLK, VA
MARI BETH ANDRIE	WUY3362	ANDRIE INC	CHICAGO, IL
MERCURY	3FFC7	CELEBRITY CRUISE LINE	MIAMI, FL
NADA II	ELAV2	NYK SHIP MANG. CO., LTD	SEATTLE, WA
NOBLE STAR	3FRU7	WORLD MARINE CO., LTD	SEATTLE, WA
NOL AMAZONITE	9VBX	NOL (USA)	LOS ANGELES, CA
OLIVIA	ELRY4	INCHCAPE SHIPPING SERVICES	NEWARK, NJ
ORIANA	GVSN	PRINCESS CRUISES	MIAMI, FL
PETERSBURG	WJDC	KEYSTONE SHIPPING CO	HOUSTON, TX
PRINCESS CLIPPER	VRUC4	CAPES SHIPIPING AGENCIES INC.	NORFOLK, VA
PUDONG SENATOR	DQVI	REEDERIE F. LAEISZ G.M.B.H.	SEATTLE, WA
R/V NEESKAY	WY8293	UNIV. OF WISC.-WATER INST.	CHICAGO, IL
REBECCA LYNN	WCW7977	ANDRIE INC	CHICAGO, IL
RED ROSE	P3DM3	CAPES SHIPPING AGENCY	NORFOLK, VA

Continued on Page 63

Continued from Page 62

NAME OF SHIP	CALL	AGENT NAME	RECRUITING PMO
ROSSEL CURRENT	J8FI6	GULF & ATLANTIC MARITIME	HOUSTON, TX
ROYAL ETERNITY	DUXW	KOYO LINE CO. LTD.	NORFOLK, VA
ROYAL PILOT	3FKK4	KOYO LINE LTD.	SEATTLE, WA
S/S OSPREY	KUS5197	S/S OSPREY	MIAMI, FL
SAUDI ABHA	HZRX	BIEHL & COMPANY	HOUSTON, TX
SAUDI HOFUF	HZZC	NORTON LILLY INTERNATIONAL	HOUSTON, TX
SEA COUGAR	DHHB	CROWLEY AMERICAN TRANSPORT	JACKSONVILLE, FL
SEA LYNX	DGOO	CROWLEY AMERICAN TRANSPORT	JACKSONVILLE, FL
SEA MARCELA "R"	3FOE6	SEABOARD MARINE	MIAMI, FL
SEA-LAND CHARGER	V7AY2	SEA-LAND SERVICES	LOS ANGELES, CA
SEA-LAND EAGLE	V7AZ8	WESTERN OVERSEAS CORP.	LOS ANGELES, CA
SEABOARD CARIBE	ELRV7	SEABOARD MARINE	MIAMI, FL
SEABOARD CLIPPER	V2NW	SEABOARD MARINE	MIAMI, FL
SEABOARD EXPRESS	3ENX5	SEABOARD MARINE	MIAMI, FL
SEABOARD FLORIDA	3FBW5	SEABOARD MARINE	MIAMI, FL
SEABOARD INTREPID	3EMV5	SEABOARD MARINE	MIAMI, FL
SEABOARD MARINER	C6HH3	SEABOARD MARINE	MIAMI, FL
SEABOARD MARLIN	V2RP	SEABOARD MARINE	MIAMI, FL
SEABOARD SPIRIT	V2AG2	SEABOARD MARINE	MIAMI, FL
SEABOARD STAR	3FBV5	SEABOARD MARINE	MIAMI, FL
SEABOARD TRADER	3FLH5	SEABOARD MARINE	MIAMI, FL
SEABOARD VENTURE	LATJ2	SEABOARD MARINE	MIAMI, FL
SEABOARD VOYAGER	3FOM4	SEABOARD MARINE	MIAMI, FL
SINCERE PROMINENCE	3EPF3	EMPIRE SHIPPING CO., LTD.	SEATTLE, WA
TAKAMINE	LACT5	STEVENS SHIPPING & TERMINAL	JACKSONVILLE, FL
TAKASAGO	LACR5	STEVENS SHIPPING & TERMINAL	JACKSONVILLE, FL
TEXAS	LMWR3	WILHELMSEN LINES (USA) INC.	BALTIMORE, MD
TIGER FALCON	DXKP	FAIRMONT SHIPPING CANADA	SEATTLE, WA
TOWER BRIDGE	ELJL3	K-LINE AMERICA INC	SEATTLE, WA
USNS GILLILAND	NAMJ	HASLER AND COMPANY	NORFOLK, VA
USNS SODERMAN	NANL	HASLER AND COMPANY	NORFOLK, VA
VICTORIA	GBBA	PRINCESS CRUISES	MIAMI, FL

From left to right, Jim Saunders, PMO Baltimore; Oscar Ramos and Miriam Andrioli of the Argentinian Meteorological Service; and Vince Zegowitz, Voluntary Observing Ships Program Leader, NWS, onboard the **Charles Lykes** *in Baltimore Harbor while observing the day-to-day operations of a PMO. Mr. Ramos and Ms. Andrioli were in the USA training to become instructors in establishing and maintaining Voluntary Observing Ship (VOS) programs in Spanish-speaking countries.*

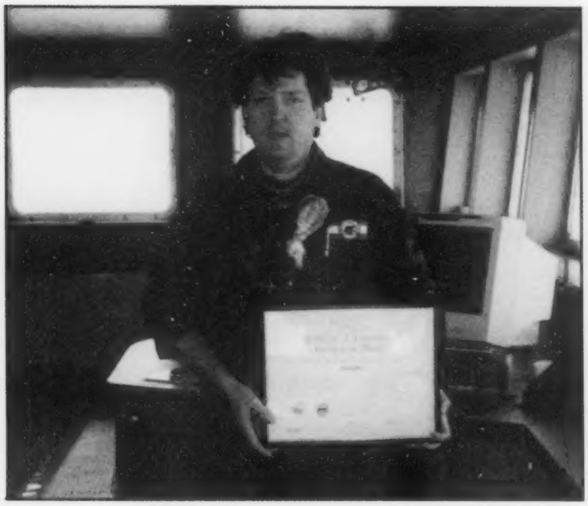


PMO George Smith of Cleveland presented a 1996 VOS award to Capt. George O. Herdina (right) and 2nd Mate Raymond F. Groh (left) of the **Str. Medusa Challenger.**

MV Frontenac *received the Gold Seal for participation in the Great Lakes VOS program of Environment Canada. Pictured from left to right are Captain Ken Ford and 1st Officer Dave Dillon.*

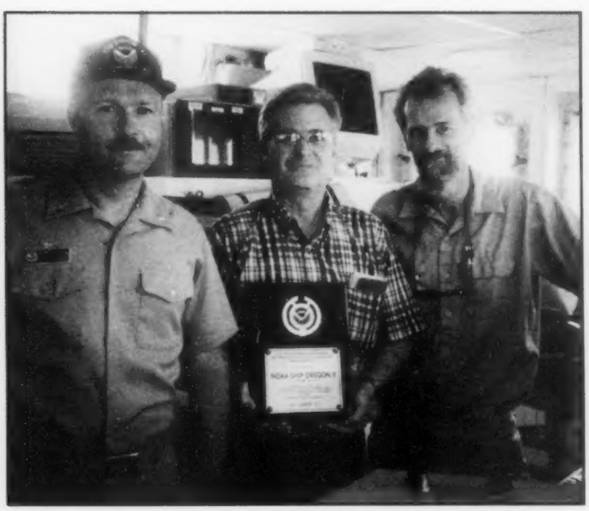
Canadian Coast Guard Ship **Samuel Risley** *receiving the Gold Seal for participation and also receiving the U.S. Observers Handbook. Pictured from left to right are Quartermaster William Dawson, Captain Adriaan Cooiman, Quartermaster Roger Ritchie, and Quartermaster Barnie Bethel.*

Canadian Coast Guard Ship **Griffon** *receiving the Gold Seal for participation. Pictured from left to right are Captain Rene Turenne, 2nd Officer Darlene Sampson, and Quartermaster Paul Duguay.*



The Gold Seal for participation in Environment Canada's VOS program was presented to 3rd Officer Dave McPhee of the **MV Algoport**.

The NOAA Ship **Chapman** *was presented with a 1996 VOS award. Pictured from left to right are New Orleans PMO Jack Warrelmann, CO Mark Ablondi, and SF Tim Lewis.*



A 1996 VOS plaque was awarded to NOAA Ship **Oregon II**. *Pictured from left to right are LCDR Jon Rix, PMO Jack Warrelmann, and 1st Officer Jim Rowe.*

The **USNS Pathfinder** *was presented with a VOS plaque on 20 August 1997. Pictured from left to right: 2nd Mate/Navigator Douglas Casavant, 3rd Mate Harold Smith, and Chief Mate Charles Rodriguez. The ship is a forward-deployed oceanographic survey vessel operated by Military Sealift Command.*

A Familiarization Float Aboard the Coast Guard Cutter Storis

April 14-29, 1997

Tom Paylor
NWSFO Anchorage, Alaska

Introduction

From April 14-29, 1997, I had the privilege of accompanying the U.S. Coast Guard Cutter **Storis** on patrol. The route consisted of travel from Kodiak to the Alaska Peninsula waters, Eastern Aleutians, Bristol Bay, and the eastern Bering Sea, ending on St. Paul Island. During the journey, I observed numerous Coast Guard activities including vessel boardings, gunnery exercises, and safety drills. While onboard, I was able to examine Coast Guard weather operations. I conducted some training sessions to help them improve their taking of weather observations and answered questions regarding the National Weather Service's products.

Storis is the oldest cutter in the Coast Guard. She is a 230-foot, 1,700-ton icebreaker propelled by three 600-horsepower diesel-electric engines. Her maximum cruising speed is just under 15 knots. The crew during this trip consisted of 53 enlisted men and women, 10 officers, and myself. The captain was Commander Blaine Horrocks, a U.S. Coast Guard Academy graduate, who has been in charge of the **Storis** since summer 1996.

The Route of the Trip

We headed out of Kodiak on the morning of April 15th under fair skies and light winds. A cold front moving through from the northwest brought us the first foul weather of the trip on the morning of the 16th. Located just to the southwest of Kodiak Island at that time, winds recorded by **Storis** were out of the northwest at 30G40 knots and seas 12 ft. With winds higher than forecast, the captain opted to take us a bit more inside to cut down on the seas. We turned northwestwards and headed toward the Alaska Peninsula. The cold air advection was over by late that afternoon. Winds had diminished to northwest 10 knots by 6 pm, as we entered the waters south of the Alaska Peninsula just to the southeast of Chignik.

Heading toward the Shumagin Islands, we continued our westward journey toward Dutch Harbor. The crew conducted a ship boarding to the south of Sand Point, on the morning of the 17th. At the time, winds were nearly calm, but due to an approaching storm, the forecast for our operating area called for winds increasing to NE40 knots by the afternoon of the 18th—about the time we were scheduled to arrive in Dutch Harbor.

We transited Unimak Pass during the early morning hours of the 18th and anchored in Summer Bay just outside of Dutch Harbor, waiting to dock at the Delta Western pier later that day. Winds were a bit lighter than forecast, from the northeast at 30 knots with higher gusts (which still made for a very tricky docking). That afternoon, I visited the airport, Grand Aleutian Hotel, and saw many huge container ships. Capt. Horrocks commented that even the largest of these could travel at speeds in excess of 20 knots. After a great seafood dinner on **Storis**, we headed northeastward from Dutch Harbor and along the waters to the north of the Alaska Peninsula. We then milled about in Bristol Bay through the 20th, patrolling the yellowfin sole and Pacific cod fisheries.

April 20-21 were the most interesting weather days of the trip. A very strong arctic front dropped down the west coast of Alaska through the period. We were located about 100 miles northwest of Cold Bay on the afternoon of the 20th. Our winds were out of the north-northeast at 20 knots with 8 ft. seas. That evening, the front passed us. Winds backed to the north-northwest and were gusting to 35 knots. Seas were up to 14 ft. by the morning of the 21st, and the air temperature had fallen into the upper 20s. This provided a good recipe for freezing spray. **Storis** accumulated about one half of an inch of ice on the bow. The icing never became a problem, however, since air temperatures never dropped below the upper 20s. Thirty-five knot gales continued out of the north-northwest through the afternoon of the 21st, but conditions had quieted down considerably by the morning of the 22nd.

The next significant weather system approached the area from the south on the 23rd. **Storis** had sustained winds at 25-35 knots from the afternoon of the 23rd to the evening of the 24th. Maximum seas during this time were about 14 ft., and there was intermittent

Continued on Page 68

Fam Float

Continued from Page 67

rain and snow. By the 25th, conditions had calmed quite a bit and would remain that way for the remainder of the trip.

On the 26th, we were about 75 miles to the east of St. Paul, and the crew conducted a gunnery exercise with their 25mm gun and .50 caliber machine gun. After the gunnery exercise was completed, we turned southeastward toward the Alaska Peninsula again. We stopped near Bechevin Bay, located off of the east end of Unimak Island, on the morning of the 27th. I had the chance to go ashore there with a landing party in the Zodiac. During the patrol, we saw quite a bit of wildlife including many whales, birds, and some LARGE bear tracks. Later that evening, we began our return to the Pribilofs.

We anchored just outside of the harbor in St. Paul on the evening of the 28th. The captain and a couple of the crew took the small boat into the harbor to see if the **Storis** could make a go of docking in the morning. They determined it was possible. On the morning of the 29th, the **Storis** became the first Coast Guard Cutter to ever tie up at the dock in St. Paul. After a tour of the Coast Guard LORAN station, I returned to Kodiak on a Coast Guard C-130. On the flight back, the C-130 conducted vessel sightings in Bristol Bay, often flying at only two hundred feet above the water in order to get fishing vessel names and locations for their cutters.

Going to pick up a boarding party on the Bering Sea.

Weather Operations Onboard

The **Storis** received text products from three sources: the National Weather Service, the U.S. Navy, and the Coast Guard Air Station in Kodiak. The NWS's coastal forecasts for the Kodiak Island Waters, Bristol Bay, and the eastern Aleutians were the most utilized of all of the text products. Received via HF from the Coast Guard Communications Station at Kodiak, these products were the first weather items the captain would examine. They were typically available within 30 minutes of the product's valid time. The Navy products consisted of a route specific forecast for the **Storis** and a High Seas Warning product. The Coast Guard product was written primarily for their aviation operations but did contain a condensed version of the NWS's offshore marine forecast.

The sole source of graphical information available to the **Storis** was the weather facsimile. Many times on my trip, the fax reception was much less than acceptable. The region to the southwest of Kodiak Island is notorious for the lack of weather fax data, and, while in this area, we received no faxes for 40 consecutive hours. The officers told me that they believed this was due to Barometer Mountain blocking the signal transmission.

One simple way for the Coast Guard to circumvent the problems with the weather faxes would be to link to the Internet while at sea. Captain Horrocks's goal, before he leaves the **Storis** in mid-1998, is to be able to download graphical products off of the Internet while in the central Bering Sea. One of the officers, Lt. Sam Sumpter, has accessed the Alaska Region's home page and has a printout of one the surface maps on his wall onboard **Storis** with a sign saying, "Look what we could have if we

Continued on Page 69

Fam Float

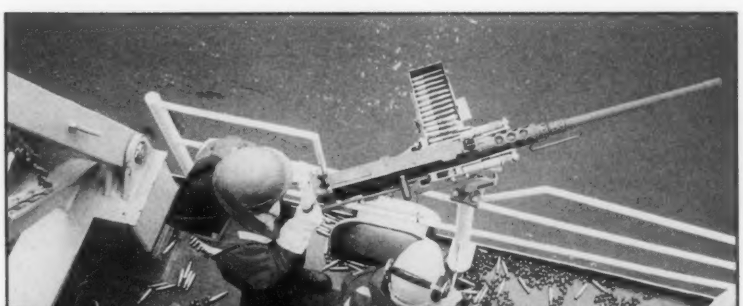
Continued from Page 68

had access to the Internet!" The crew spoke very highly of our home page. In the near future, they are hopeful that their Internet wishes will become a reality.

NWS HF and VHF broadcasts were also utilized but were generally not a primary information source for **Storis**. The captain mentioned that, while **Storis** does not use the radio broadcasts with much regularity, they are still an important tool for some of the smaller fishing vessels. The HF broadcasts were of good quality, and we even heard Yakutat one night while patrolling in Bristol Bay.

Marine observations are an important part of operations aboard **Storis**. Every hour, the quartermaster on duty took a complete weather observation that included: wind, sky cover, precipitation, dry and wet bulb temperatures, pressure, wind waves, swells, visibility, and ice coverage. An observation was transmitted every three hours to the world over HF. A number of groups are working to improve the reception of these observations into the NWS database. There are typically at least four cutters operating in Alaskan waters at any given time. Getting observations from them every three hours would be like having floating buoys.

In order to help the **Storis**'s crew perform better as observers, I held a training session for the quartermasters and captain. At this session the NWS's Voluntary Observing Ship Program video was shown. We had a discussion about specific points of their observations, including visibility, precipitation types, and, most notably, sea heights, where there was a tendency to under-report the values.



Gunnery exercises in the Bering Sea.

One weather event that countless members of the crew wanted to talk about was the Bering Sea storm of early November 1996. The low was even pictured on the ship's Christmas card. Some of the crew shot video during the event. **Storis** was 100 miles or so from Buoy #35 in the Bering Sea when the buoy was reporting close to 50 foot seas! **Storis**'s observations during the event had winds at 70G80 knots and 43 foot seas! They were hammered relentlessly for three days. The Coast Guard's buoy tenders hate to service Buoy #35 because of the large number of strong storms that affect the Bering. Several of the crew had been through hurricanes in the Carribean, including Luis, and said the November 1996 Bering storm was worse than anything in which they had ever been! Who says we don't have weather in Alaska?

Conclusion

I would like to thank the **Storis** for their hospitality and the knowledge I gained while onboard. Hopefully, they learned something from me as well. Captain Horrocks encourages any other interested forecasters to go on patrol with them. It is a great learning experience for meteorologists and sailors. This sharing of information presents an opportunity to learn about each other's roles in weather and is very beneficial to both agencies.

VOS Cooperative Ship Reports — 2nd and 3rd Quarters 1997

The National Climatic Data Center compiles the tables for the VOS Cooperative Ship Report from radio messages and weather logs. The three columns under the heading "MANUSCRIPT RECEIVED" denote whether or not a form was received for that month (Y/N). Forms are considered late (L) if they arrive more than 60 days after the data month. Some ships may show 100% radio observations but show forms were also received. This occurs when the mail and radio observations are duplicated. The observation count does not reflect duplicates.

Port Meteorological Officers supply ship names to the NCDC. Comments or questions regarding this report should be directed to NCDC, Operations Support Division, 151 Patton Avenue, Asheville, NC 28801 Attn: Dimitri Chappas (704-271-4437 or dchappas@ncdc.noaa.gov).

NAME	TOTAL OBS	MANUSCRIPT RECEIVED		
		APR	MAY	JUN
1ST LT ALEX BONNYMAN	121	N	Y	N
2ND LT. JOHN P. BOBO	11	N	N	N
A. V. KASTNER	109	N	N	N
AALSMEERGRACHT	147	N	N	N
ACADIA FOREST	180	Y	Y	Y
ACT 7	209	N	N	N
ACT I	101	N	N	N
ADAM E. CORNELIUS	129	Y	N	Y
ADVANTAGE	135	Y	Y	Y
AGULHAS	125	N	N	Y
AL AWDAH	328	N	N	N
AL SAMIDOON	52	N	N	N
AL SHUHADAA	131	N	N	N
ALBEMARLE ISLAND	61	Y	N	N
ALBERNI DAWN	584	N	N	N
ALDEN W. CLAUSEN	40	Y	Y	N
ALKMAN	182	N	N	N
ALLEGIANCE	134	Y	Y	Y
ALLIGATOR AMERICA	126	N	N	N
ALLIGATOR BRAVERY	196	N	Y	N
ALLIGATOR COLUMBUS	68	Y	Y	N
ALLIGATOR GLORY	33	Y	Y	Y
ALLIGATOR LIBERTY	126	N	N	N
ALLIGATOR STRENGTH	174	Y	Y	Y
ALMERIA LYKES	96	Y	Y	Y
ALPENA	129	Y	N	Y
ALPHA HELIX	222	Y	Y	Y
AMALIA	136	Y	Y	N
AMAZON	73	Y	N	Y
AMBASSADOR	9	Y	N	N
AMBASSADOR BRIDGE	284	Y	N	Y
AMERICA STAR	178	N	N	N
AMERICAN CONDOR	199	Y	Y	Y
AMERICAN FALCON	37	Y	Y	N
AMERICANA	48	Y	Y	Y
AMERIGO VESPUCCI	37	Y	N	N
ANAHUAC	74	N	N	N
ANASTASIS	101	N	N	N
ANATOLIY KOLESNICHENKO	31	N	N	N
ANDERS MAERSK	210	Y	Y	Y
ANKERGRACHT	120	N	N	N
ANNA	55	N	N	N
ANNA MAERSK	156	Y	Y	Y
AOMORI WILLOW	2	N	N	N
APL CHINA	200	N	N	N
APL JAPAN	117	Y	N	N
APL KOREA	61	N	N	N
APL PHILIPPINES	248	N	N	N
APL SINGAPORE	73	N	N	N
APL THAILAND	253	N	N	N
ARABIAN SEA	41	Y	Y	Y
ARABIAN SENATOR	104	N	N	N
ARCO ALASKA	75	Y	N	Y
ARCO ANCHORAGE	20	N	Y	Y
ARCO CALIFORNIA	19	Y	N	N
ARCO FAIRBANKS	41	Y	Y	Y
ARCO INDEPENDENCE	47	Y	N	N
ARCO JUNEAU	31	Y	Y	Y
ARCO SAG RIVER	42	Y	Y	Y
ARCO SPIRIT	49	Y	Y	N
ARCTIC OCEAN	193	Y	Y	N
ARCTIC SUN	93	Y	Y	Y
ARCTIC UNIVERSAL	84	N	N	N
ARGONAUT	95	Y	Y	Y
ARIES	23	N	N	N
ARKTIS LIGHT	313	Y	Y	Y
ARKTIS SPRING	196	Y	Y	Y
ARKTIS STAR	1	N	N	N
ARKTIS SUN	8	N	N	N
ARMCO	105	Y	N	Y
ARTHUR M. ANDERSON	218	Y	Y	Y
ARTHUR MAERSK	178	Y	Y	Y
ASPHALT COMMANDER	46	Y	N	Y
ATLANTIC	640	N	N	N
ATLANTIC BULKER	79	N	N	N
ATLANTIC COMPANION	76	N	N	N
ATLANTIC COMPASS	84	N	N	N
ATLANTIC CONCERT	85	N	N	N
ATLANTIC CONVEYOR	27	N	N	N
ATLANTIC ERIE	32	N	N	N
ATLANTIC SUPERIOR	96	N	N	N
ATLANTIS	6	N	N	N

Continued on Page 71

Continued from Page 70

NAME	TOTAL OBS	MANUSCRIPT RECEIVED APR	MAY	JUN
AUCKLAND STAR	168	N	N	N
AUSTRAL RAINBOW	25	Y	N	N
AUTHOR	129	N	N	N
AXEL MAERSK	124	Y	N	N
B. T. ALASKA	183	Y	N	Y
BANDA SEAHORSE	357	Y	N	Y
BARBARA ANDRIE	71	N	Y	Y
BARRINGTON ISLAND	159	Y	Y	Y
BAY BRIDGE	76	Y	Y	Y
BELGRANO	87	N	N	N
BERING SEA	178	Y	N	Y
BERNARDO QUINTANA A	119	Y	Y	Y
BLOSSOM FOREVER	30	N	N	N
BLUE GEMINI	150	Y	Y	Y
BLUE NOVA	181	Y	Y	Y
BONN EXPRESS	844	N	N	N
BOSPORUS BRIDGE	249	Y	Y	Y
BOW TRIGGER	62	N	N	N
BP ADMIRAL	17	N	N	N
BREMEN EXPRESS	853	N	N	N
BRIGHT PHOENIX	202	Y	Y	Y
BRIGIT MAERSK	134	N	N	N
BRISBANE STAR	83	N	N	N
BRITISH ADVENTURE	90	N	N	N
BRITISH RANGER	198	N	N	N
BROOKLYN BRIDGE	154	N	N	N
BRUCE SMART	111	N	Y	Y
BT NAVIGATOR	80	N	N	N
BT NIMROD	45	N	N	N
BUCKEYE	242	Y	Y	Y
BUFFALO SOLDIER	3	N	N	N
BUNGA SAGA TIGA	126	Y	Y	N
BURNS HARBOR	445	Y	Y	Y
CABO TAMAR	125	N	N	N
CALCITE II	41	N	N	Y
CALIFORNIA CURRENT	107	N	N	N
CALIFORNIA JUPITER	120	N	N	N
CALIFORNIA LUNA	79	N	N	N
CALIFORNIA MERCURY	49	N	N	N
CALIFORNIA PEGASUS	44	N	N	N
CALIFORNIA SATURN	33	Y	N	N
CALIFORNIA TRITON	67	N	Y	N
CALIFORNIA ZEUS	78	Y	N	N
CANBERRA	59	N	N	N
CAPE BREEZE	68	N	N	N
CAPE CHARLES	47	N	N	N
CAPE HENRY	51	N	N	Y
CAPE MAY	42	N	N	N
CAPE MOHICAN	86	Y	N	N
CAPE RISE	1	Y	N	N
CAPE WASHINGTON	48	N	N	Y
CAPE WRATH	4	N	N	N
CARAVOS STAR	2	N	N	N
CARDIGAN BAY	144	N	N	N
CARLA A. HILLS	117	Y	Y	N
CASON J. CALLAWAY	248	Y	Y	Y
CELEBRATION	42	Y	Y	N
CENTURY	66	Y	Y	N
CENTURY HIGHWAY #2	43	N	N	N
CENTURY HIGHWAY NO. 1	52	N	N	N
CENTURY HIGHWAY_NO. 3	29	N	N	N
CENTURY LEADER NO. 1	98	N	N	N
CGM PROVENCE	35	N	N	N
CHARLES E. WILSON	94	Y	N	Y
CHARLES ISLAND	95	Y	N	Y

NAME	TOTAL OBS	MANUSCRIPT RECEIVED APR	MAY	JUN
CHARLES LYKES	183	Y	N	N
CHARLES M. BEEGHLEY	254	Y	N	Y
CHARLES PIGOTT	170	Y	Y	N
CHASTINE MAERSK	149	Y	Y	Y
CHELSEA	31	N	N	Y
CHEMICAL PIONEER	59	Y	N	N
CHESAPEAKE TRADER	76	Y	N	N
CHEVRON ARIZONA	60	Y	Y	Y
CHEVRON ATLANTIC	89	Y	N	Y
CHEVRON COLORADO	124	N	Y	N
CHEVRON EDINBURGH	247	Y	Y	N
CHEVRON EMPLOYEE PRIDE	177	Y	Y	Y
CHEVRON MARINER	174	Y	Y	N
CHEVRON MISSISSIPPI	79	Y	N	Y
CHEVRON OREGON	1	N	N	N
CHEVRON SOUTH AMERICA	186	Y	Y	Y
CHIEF GADAO	97	Y	Y	N
CHILEAN EXPRESS	9	N	N	N
CHINA HOPE	8	N	N	N
CHIQUITA BARU	118	N	N	N
CHIQUITA BELGIE	107	N	N	N
CHIQUITA BREMEN	130	N	N	N
CHIQUITA BRENDA	179	N	N	N
CHIQUITA DEUTSCHLAND	137	N	N	N
CHIQUITA ELKESCHLAND	105	N	N	N
CHIQUITA FRANCES	155	N	N	N
CHIQUITA ITALIA	104	N	N	N
CHIQUITA JEAN	128	N	N	N
CHIQUITA JOY	180	N	N	N
CHIQUITA NEDERLAND	14	N	N	N
CHIQUITA SCANDINAVIA	142	N	N	N
CHIQUITA SCHWEIZ	222	N	N	N
CHOYANG VISION	140	Y	Y	N
CIELO DI FIRENZE	240	N	N	Y
CITY OF DURBAN	145	N	N	N
CLEVELAND	115	Y	N	N
CMS ISLAND EXPRESS	43	Y	Y	Y
COASTAL EAGLE POINT	1	N	N	N
COLUMBIA BAY	22	N	N	N
COLUMBIA STAR	559	N	N	N
COLUMBINE	189	Y	N	N
COLUMBUS AMERICA	45	N	N	N
COLUMBUS CALIFORNIA	90	N	N	N
COLUMBUS CANADA	192	N	N	N
COLUMBUS NEW ZEALAND	44	N	N	N
COLUMBUS QUEENSLAND	64	N	N	N
COLUMBUS VICTORIA	112	N	N	N
CONTIENTAL WING	68	N	N	N
CONTSHIP AMERICA	42	N	N	N
CONTSHIP HOUSTON	103	Y	Y	Y
CORAL HIGHWAY	16	N	N	N
CORDELIA	48	N	N	Y
CORMORANT ARROW	17	N	N	N
CORNELIA MAERSK	148	Y	N	N
CORNUCOPIA	3	N	N	N
CORPUS CHRISTI	14	Y	N	N
CORWITH CRAMER	85	Y	Y	N
COSMOWAY	30	Y	Y	N
COURAGEOUS	32	Y	Y	N
COURIER	20	N	N	N
COURTNEY BURTON	332	Y	N	Y
COURTNEY L	8	N	N	N
CRANE PACIFIC	43	N	N	N
CRISTOFORO COLOMBO	20	N	Y	N
CROATIA EXPRESS	13	N	N	N

Continued on Page 72

Continued from Page 71

NAME	TOTAL OBS	MANUSCRIPT RECEIVED APR	MAY	JUN
CROWN OF SCANDINAVIA	276	N	N	N
CROWN PRINCESS	227	Y	N	Y
CRYSTAL HARMONY	10	N	N	N
CSK UNITY	103	Y	N	Y
CSL CABO	51	N	N	N
CSS HUDSON	119	N	N	N
DAGMAR MAERSK	102	N	N	N
DAISHIN MARU	13	N	N	N
DARYA PREETH	141	N	N	N
DAVID Z. NORTON	6	Y	N	N
DELAWARE TRADER	190	Y	N	N
DENALI	90	Y	N	Y
DESTINY	192	Y	Y	N
DG COLUMBIA	183	Y	Y	Y
DIAMOND STAR	8	N	N	N
DIRCH MAERSK	86	Y	N	Y
DIRECT EAGLE	135	N	N	N
DIRECT FALCON	267	Y	N	N
DIRECT KEA	151	N	N	N
DIRECT KIWI	211	Y	Y	Y
DIRECT KOOKABURRA	110	Y	Y	N
DOCK EXPRESS 20	182	N	N	N
DOCTOR LYKES	124	Y	N	N
DORTHE MAERSK	139	N	N	N
DORTHE OLDENDORFF	138	Y	N	N
DOUBLE GLORY	6	N	N	N
DRYSO	1	N	N	N
DUBROVNIK EXPRESS	46	N	N	N
DUCHESS	8	Y	N	N
DUHALLOW	161	N	N	N
DUNCAN ISLAND	232	Y	Y	Y
DUSSELDORF EXPRESS	780	N	N	N
E.P. LE QUEBECOIS	671	N	N	N
EARL W. OGLEBAY	10	N	N	N
ECSTASY	122	Y	Y	Y
EDELWIESS	89	N	N	N
EDGAR B. SPEER	283	Y	Y	Y
EDWARD L. RYERSON	9	N	Y	N
EDWIN H. GOTT	448	Y	Y	Y
EDYTH L	45	Y	N	N
ELISE SHULTE	93	Y	N	N
ELLEN KNUDSEN	2	N	N	N
ELLIOTT BAY	169	Y	Y	N
ELTON HOYT II	72	N	N	Y
EMPIRE STATE	74	N	N	N
ENGLISH STAR	215	N	N	N
EQUATORIAL LION	30	N	N	N
EQUINOX	134	N	N	N
EVER GAINING	12	N	N	N
EVER GALLANT	6	N	N	N
EVER GARDEN	7	N	N	N
EVER GENERAL	17	N	N	N
EVER GENIUS	15	N	N	N
EVER GIVEN	1	N	N	N
EVER GLEEFUL	12	N	N	N
EVER GOING	1	N	N	N
EVER GOVERN	31	Y	Y	N
EVER GROUP	3	N	N	N
EVER GUARD	2	N	N	N
EVER GUEST	3	N	N	N
EVER LEVEL	45	N	Y	N
EVER REPUTE	21	Y	N	N
EVER RESULT	31	N	N	N
EVER RIGHT	4	N	N	N
EVER ROUND	1	N	N	N
EVER ULTRA	71	N	N	N
EVER UNISON	1	N	N	N
EVER UNITED	6	N	N	N
EWL VENEZUELA	96	N	N	N
EXCELSIOR	194	N	N	N
EXEMPLAR	140	N	N	N
EXPORT PATRIOT	111	Y	Y	N
FAIRLIFT	84	N	N	N
FANAL TRADER	73	Y	Y	N
FANTASY	49	Y	Y	Y
FARALLON ISLAND	226	N	N	N
FASCINATION	96	Y	Y	N
FAUST	119	Y	Y	N
FERNCROFT	50	N	N	N
FIDELIO	130	Y	Y	N
FIGARO	11	N	N	N
FLORAL LAKE	3	N	N	N
FOREST CHAMPION	108	N	Y	Y
FRANCES HAMMER	64	N	N	N
FRANCES L	312	Y	N	Y
FRANKFURT EXPRESS	52	N	N	N
FRED R. WHITE JR	79	Y	N	Y
GALAXY ACE	18	N	N	N
GALVESTON BAY	74	Y	N	N
GENEVIEVE LYKES	60	Y	N	N
GEORGE A. SLOAN	226	Y	Y	Y
GEORGE A. STINSON	220	N	Y	Y
GEORGE H. WEYERHAEUSER	174	N	N	Y
GEORGE SCHULTZ	117	N	Y	Y
GEORGE WASHINGTON BRID	162	Y	Y	Y
GEORGIA RAINBOW II	177	Y	Y	N
GERMAN SENATOR	6	N	N	N
GERONIMO	13	N	N	N
GLOBAL LINK	424	Y	N	Y
GLOBAL MARINER	75	Y	N	N
GLOBAL NEXTAGE	33	N	N	N
GLOBAL SENTINEL	5	N	N	N
GLORIOUS SUCCESS	59	Y	N	Y
GLORIOUS SUN	139	Y	Y	N
GOLDEN APO	34	N	N	N
GOLDEN BEAR	266	N	Y	Y
GOLDEN GATE	131	Y	N	N
GOLDEN GATE BRIDGE	157	Y	Y	Y
GOPHER STATE	47	Y	N	N
GREAT LAND	130	Y	Y	Y
GREEN BAY	182	Y	Y	Y
GREEN ISLAND	75	Y	Y	N
GREEN LAKE	315	Y	N	Y
GREEN MAYA	42	N	N	N
GREEN RAINIER	17	N	N	N
GREEN RIDGE	120	Y	Y	N
GREEN SASEBO	50	Y	N	Y
GRETKE OLDENDORFF	269	Y	N	Y
GROTON	79	Y	N	Y
GROWTH RING	229	N	N	N
GUANAJUATO	59	Y	N	N
GUAYAMA	234	Y	Y	N
GULF CURRENT	191	Y	N	Y
GULF SPIRIT	5	N	N	N
GULL ARROW	19	N	N	N
GYPSUM BARON	88	N	N	N
GYPSUM KING	170	N	N	N
H. LEE WHITE	74	Y	N	Y
HADERA	42	N	N	N
HANDY ISLANDER	16	Y	N	N

Continued on Page 73

Continued from Page 72

NAME	TOTAL OBS	MANUSCRIPT RECEIVED APR	MAY	JUN
HANJIN BARCELONA	34	N	N	N
HANJIN BREMEN	7	N	N	N
HANJIN COLOMBO	15	N	N	N
HANJIN ELIZABETH	8	N	N	N
HANJIN FELIXSTOWE	3	N	N	N
HANJIN HAMBURG	9	N	N	N
HANJIN KAOHSIUNG	16	N	N	N
HANJIN LE HAVRE	24	N	N	N
HANJIN OAKLAND	14	N	N	N
HANJIN PORTLAND	33	Y	Y	N
HANJIN ROTTERDAM	20	N	N	N
HANJIN SHANGHAI	34	N	N	N
HANJIN TOKYO	11	N	N	N
HANJIN VANCOUVER	15	N	N	N
HANSA CARRIER	102	N	Y	Y
HARBOUR BRIDGE	67	Y	Y	Y
HARMONY ACE	3	N	N	N
HAVELLAND	30	N	N	N
HEICON	83	N	Y	Y
HEIDELBERG EXPRESS	487	N	N	N
HELVETIA	94	Y	Y	N
HENRY HUDSON BRIDGE	194	N	N	N
HERBERT C. JACKSON	64	Y	N	Y
HESIOD	6	N	N	N
HOEGH CLIPPER	12	N	N	N
HOEGH DRAKE	66	N	Y	Y
HOEGH DYKE	11	N	N	N
HOEGH MERIT	96	Y	Y	N
HOEGH MINERVA	67	Y	N	N
HOLCK LARSEN	12	N	N	N
HONSHU SILVIA	169	Y	N	Y
HOOD ISLAND	29	N	N	N
HOUSTON	311	N	N	N
HOUSTON EXPRESS	81	N	N	N
HUAL CARMENCITA	21	N	N	N
HUAL INGRITA	20	Y	Y	N
HUAL ROLITA	10	N	N	N
HUMACAO	88	Y	Y	N
HUMBERGRACHT	120	N	N	N
HUMBOLT CURRENT	1	N	N	N
HUME HiGHWAY	63	N	N	N
HYUNDAI DISCOVERY	96	N	N	N
HYUNDAI DYNASTY	172	N	N	N
HYUNDAI FIDELITY	154	Y	Y	Y
HYUNDAI FORTUNE	18	N	N	N
HYUNDAI FREEDOM	97	N	N	N
HYUNDAI INDEPENDENCE	159	Y	Y	Y
HYUNDAI LIBERTY	6	N	N	N
IGARKA	8	N	N	N
IMAGINATION	65	Y	Y	Y
INDIANA HARBOR	319	Y	Y	Y
INLAND SEAS	18	N	Y	Y
INSPIRATION	219	Y	Y	Y
IOWA TRADER	5	N	N	N
ISLA DE CEDROS	39	N	N	N
ISLA GRAN MALVINA	39	N	N	N
ISLAND BREEZE	39	N	N	N
ISLAND PRINCESS	4	N	N	N
ITB BALTIMORE	35	Y	N	N
ITB MOBILE	75	Y	Y	N
ITB NEW YORK	32	Y	N	N
IVER EXPLORER	12	N	N	N
IVER EXPRESS	16	N	N	N
IVYBANK	34	N	N	N
IWANUMA MARU	258	Y	Y	Y

NAME	TOTAL OBS	MANUSCRIPT RECEIVED APR	MAY	JUN
J. DENNIS BONNEY	78	N	Y	Y
JACKLYN M.	96	Y	N	Y
JACKSONVILLE	240	Y	N	Y
JADE ORIENT	25	N	N	N
JADE PACIFIC	35	N	N	N
JAHRE SPIRIT	3	N	N	N
JAMES	134	N	N	N
JAMES N. SULLIVAN	68	Y	N	N
JAMES R. BARKER	320	Y	N	Y
JAPAN SENATOR	168	N	N	N
JEAN LYKES	156	Y	Y	Y
JEB STUART	136	N	N	Y
JO CLIPPER	92	N	N	N
JO ELM	107	N	N	N
JOHN G. MUNSON	332	Y	Y	Y
JOHN J. BOLAND	132	Y	N	Y
JOIDES RESOLUTION	400	Y	N	Y
JOSEPH H. FRANTZ	149	Y	N	Y
JOSEPH L. BLOCK	200	Y	Y	Y
JOSEPH LYKES	1	N	N	N
JUBILEE	12	N	N	Y
JULIUS HAMMER	114	Y	Y	N
KAHO	11	N	N	Y
KAIJIN	11	N	N	N
KANSAS TRADER	101	Y	N	N
KAPITAN BYANKIN	214	Y	Y	Y
KAPITAN GNEZPILOV	42	N	N	N
KAPITAN KONEV	83	Y	N	N
KAPITAN MAN	14	N	N	N
KAPITAN SERYKH	114	Y	Y	Y
KAREN ANDRIE	59	N	Y	N
KAUAI	163	Y	Y	Y
KAYE E. BARKER	303	Y	N	Y
KAZIMAH	204	N	N	N
KEN KOKU	5	N	N	N
KEN SHIN	105	Y	Y	N
KENAI	94	Y	Y	Y
KENNETH E. HILL	179	Y	Y	Y
KENNETH T. DERR	75	Y	Y	Y
KEYSTONE GEORGIA	1	N	N	N
KINSMAN INDEPENDENT	343	Y	Y	Y
KNOCK ALLAN	11	N	N	N
KNORR	83	N	N	N
KOELN EXPRESS	845	N	N	N
KOMET	103	Y	Y	Y
KOMSOMOLETS PRIMORYA	37	N	N	N
KURAMA	11	N	N	N
KURE	34	Y	N	N
LA ESPERANZA	55	N	N	N
LA TRINITY	28	Y	N	N
LAKE CHARLES	30	N	N	N
LAKE GUARDIAN	81	Y	Y	N
LAWRENCE H. GIANELLA	68	Y	N	Y
LEE A. TREGURTHA	113	Y	N	Y
LEGEND OF THE SEAS	17	N	N	N
LEONARD J. COWLEY	16	N	N	N
LEONIA	75	N	N	N
LEOPARDI	6	N	N	N
LIBERTY SPIRIT	82	Y	Y	N
LIBERTY STAR	96	N	N	N
LIBERTY SUN	106	Y	Y	Y
LIBERTY VICTORY	19	Y	N	N
LIHUE	144	Y	Y	Y
LILAC ACE	296	N	N	N
LINDA OLDENDORF	105	N	N	N

Continued on Page 74

Continued from Page 73

NAME	TOTAL OBS	MANUSCRIPT RECEIVED APR	MAY	JUN
LIRCAY	78	Y	Y	Y
LNG AQUARIUS	122	Y	Y	N
LNG CAPRICORN	11	N	N	N
LNG LEO	83	Y	Y	Y
LNG LIBRA	173	Y	Y	N
LNG TAURUS	53	N	Y	Y
LNG VIRGO	31	Y	Y	N
LONDON ENTERPRISE	35	N	N	N
LONDON SPIRIT	132	N	N	N
LONDON VICTORY	95	N	N	N
LONG BEACH	217	Y	Y	Y
LONG LINES	84	Y	N	N
LOOTSGRACHT	63	N	N	N
LT. ODYSSEY	26	N	N	N
LTC CALVIN P. TITUS	41	N	N	Y
LUCKY GRACE	14	N	N	N
LUCY OLDENDORFF	61	N	N	N
LUISE OLDENDORFF	74	N	N	N
LURLINE	406	Y	Y	N
LUTJENBURG	169	N	N	N
MACKINAC BRIDGE	178	N	N	N
MADISON MAERSK	65	N	N	N
MAERSK CALIFORNIA	10	N	N	N
MAERSK ENDEAVOUR	641	N	N	N
MAERSK EXPLORER	475	N	N	N
MAERSK GANNET	128	N	N	N
MAERSK GIANT	675	N	N	N
MAERSK SAO PAOLO	51	N	N	N
MAERSK SHETLAND	35	N	N	N
MAERSK SOMERSET	161	N	N	N
MAERSK STAFFORD	23	N	N	N
MAERSK SUN	222	Y	Y	Y
MAERSK SURREY	77	N	N	N
MAERSK TENNESSEE	73	N	Y	N
MAGLEBY MAERSK	76	Y	Y	N
MAHARASHTRA	143	N	N	Y
MAHIMAHI	248	Y	Y	Y
MAIRANGI BAY	194	N	N	N
MAJ STEPHEN W PLESS MP	26	N	N	N
MAJESTIC MAERSK	127	Y	Y	Y
MANGAL DESAI	11	N	N	N
MANHATTAN BRIDGE	126	Y	Y	N
MANOA	195	Y	Y	Y
MANUKAI	205	Y	Y	Y
MANULANI	168	Y	Y	Y
MARCHEN MAERSK	79	Y	Y	N
MAREN MAERSK	59	Y	Y	N
MARGARET LYKES	125	Y	Y	N
MARGRETHE MAERSK	114	Y	Y	Y
MARIE MAERSK	115	Y	Y	Y
MARINE RELIANCE	15	N	N	N
MARINOR	1	N	N	N
MARIT MAERSK	75	Y	Y	Y
MARK HANNAH	224	Y	Y	Y
MARSTA MAERSK	11	N	N	N
MATHILDE MAERSK	49	N	N	N
MATSONIA	73	N	N	Y
MAUI	205	Y	Y	N
MAURICE EWING	74	N	N	N
MAYAGUEZ	153	Y	Y	N
MAYVIEW MAERSK	131	Y	N	Y
MC-KINNEY MAERSK	82	Y	Y	N
MEDUSA CHALLENGER	244	Y	Y	Y
MELBOURNE STAR	206	N	N	N
MELVILLE	287	Y	N	Y
MERCHANT PREMIER	104	N	N	N
MERCHANT PRINCE	20	N	N	N
MERIDIAN	65	Y	Y	N
MERLION ACE	46	Y	Y	Y
MESABI MINER	118	Y	N	N
METEOR	583	N	N	N
METTE MAERSK	101	Y	Y	N
MICHIGAN	172	Y	N	Y
MIDDLETOWN	80	N	N	N
MILDBURG	112	N	N	N
MING ASIA	21	N	N	N
MING PLEASURE	148	N	N	N
MING STAR	1	N	N	N
MITLA	35	N	N	N
MOANA PACIFIC	51	N	N	N
MOKIHANA	223	Y	Y	Y
MOKU PAHU	65	N	N	Y
MORELOS	179	Y	N	N
MORMACSKY	42	Y	N	N
MORMACSTAR	89	Y	N	N
MORMACSUN	54	N	N	N
MOSEL ORE	191	Y	N	N
MSC JESSICA	12	N	N	N
MUNKEBO MAERSK	39	Y	N	N
MYRON C. TAYLOR	142	Y	Y	Y
MYSTIC	20	N	N	N
NATIONAL DIGNITY	29	N	N	N
NATIONAL HONOR	34	Y	Y	Y
NATIONAL PRIDE	49	Y	Y	Y
NAUTICAS MEXICO	2	N	N	N
NEDLLOYD ABIDJAN	404	Y	N	N
NEDLLOYD DELFT	146	N	N	N
NEDLLOYD HOLLAND	239	Y	N	Y
NEDLLOYD MONTEVIDEO	100	N	N	N
NEDLLOYD RALEIGH BAY	85	N	N	N
NEDLLOYD VAN DAJIMA	167	N	N	N
NEDLLOYD VAN DIEMEN	116	N	N	N
NEGO LOMBOK	141	N	N	N
NELVANA	190	Y	Y	Y
NEPTUNE ACE	81	N	N	N
NEPTUNE JADE	34	N	N	N
NEPTUNE RHODONITE	90	N	N	N
NESLIHAN	6	N	N	N
NEW CARISSA	33	N	N	N
NEW HORIZON	177	Y	Y	Y
NEW NIKKI	193	Y	Y	Y
NEW YORK SENATOR	18	N	N	N
NEWARK BAY	155	Y	Y	N
NEWPORT BRIDGE	46	N	N	N
NIEUW AMSTERDAM	19	N	N	N
NOAA DAVID STARR JORDA	26	N	N	N
NOAA SHIP ALBATROSS IV	159	Y	N	N
NOAA SHIP CHAPMAN	471	Y	Y	Y
NOAA SHIP DELAWARE II	255	Y	Y	N
NOAA SHIP FERREL	366	Y	Y	N
NOAA SHIP KA'IMIMOANA	798	Y	N	Y
NOAA SHIP MCARTHUR	500	Y	Y	Y
NOAA SHIP MILLER FREEM	788	Y	Y	Y
NOAA SHIP OREGON II	487	Y	Y	Y
NOAA SHIP RAINIER	301	Y	Y	Y
NOAA SHIP T. CROMWELL	401	Y	N	Y
NOAA SHIP WHITING	319	Y	Y	N
NOBEL STAR	24	N	N	N
NOL AMBER	23	N	N	N
NOL DELPHI	71	N	N	N

Continued on Page 75

Continued from Page 74

NAME	TOTAL OBS	MANUSCRIPT RECEIVED		
		APR	MAY	JUN
NOL DIAMOND	7	N	N	N
NOL LAGENO	175	N	N	N
NOL RISSO	148	N	N	N
NOL RUBY	38	N	N	N
NOL STENO	173	N	N	N
NOL TOPAZ	23	N	N	N
NOL ZIRCON	61	N	N	N
NOLIZWE	163	N	N	N
NOMZI	293	Y	N	N
NORASIA SHANGHAI	4	N	N	N
NORD JAHRE TRANSPORTER	28	N	N	N
NORD PARTNER	147	Y	Y	N
NORDMAX	89	N	N	N
NORDMORITZ	41	N	N	N
NORTHERN LIGHTS	211	Y	Y	Y
NORTHERN LION	422	Y	N	Y
NORWAY	10	N	N	N
NTABENI	182	N	N	N
NUERNBERG EXPRESS	88	N	N	N
NUEVO LEON	94	N	N	N
NUEVO SAN JUAN	269	Y	Y	Y
NYK SEABREEZE	85	N	N	N
NYK SPRINGTIDE	20	N	N	N
NYK STARLIGHT	110	N	N	N
NYK SUNRISE	81	N	N	N
NYK SURFWIND	19	N	N	N
OCEAN BELUGA	44	N	N	N
OCEAN CAMELLIA	159	Y	N	N
OCEAN CITY	21	Y	N	N
OCEAN HARMONY	125	N	Y	Y
OCEAN LAUREL	10	N	N	N
OCEAN ORCHID	14	N	N	Y
OCEAN SERENE	172	Y	Y	Y
OLEANDER	155	Y	Y	N
OLIVEBANK	119	N	N	N
OLYMPIAN HIGHWAY	3	N	N	N
OMI COLUMBIA	41	N	N	N
OOCL AMERICA	48	N	N	N
OOCL CALIFORNIA	32	N	N	N
OOCL CHINA	228	Y	N	Y
OOCL ENVOY	81	N	N	N
OOCL FAIR	68	N	N	N
OOCL FAME	101	Y	N	Y
OOCL FIDELITY	273	Y	N	Y
OOCL FORTUNE	98	N	N	N
OOCL FREEDOM	117	N	N	N
OOCL FRONTIER	53	N	N	N
OOCL HONG KONG	105	Y	Y	Y
OOCL INNOVATION	175	Y	Y	Y
OOCL INSPIRATION	298	Y	N	N
OOCL JAPAN	188	N	N	N
ORANGE BLOSSOM	59	Y	Y	N
ORANGE WAVE	49	Y	N	N
ORIANA	99	N	N	N
ORIENTE GRACE	88	Y	Y	N
ORIENTE HOPE	157	Y	Y	Y
ORIENTE NOBLE	52	Y	Y	Y
ORIENTE PRIME	52	Y	Y	N
OURO DO BRASIL	54	Y	N	N
OVERSEAS ALASKA	54	Y	Y	Y
OVERSEAS ARCTIC	77	Y	Y	Y
OVERSEAS CHICAGO	28	Y	N	N
OVERSEAS HARRIET	23	N	N	N
OVERSEAS JOYCE	88	Y	N	N
OVERSEAS JUNEAU	134	Y	Y	Y
OVERSEAS MARILYN	31	N	N	N
OVERSEAS NEW ORLEANS	40	Y	N	N
OVERSEAS NEW YORK	1	Y	N	N
OVERSEAS OHIO	203	Y	Y	Y
OVERSEAS WASHINGTON	22	Y	N	N
PACASIA	100	Y	N	N
PACDUKE	74	N	N	N
PACIFIC ARIES	102	N	N	N
PACIFIC HOPE	51	Y	Y	Y
PACIFIC RAINBOW II	95	N	Y	N
PACIFIC SENATOR	88	N	N	N
PACIFIC WAVE	27	N	N	N
PACMERCHANT	31	N	N	N
PACOCEAN	21	N	N	N
PACQUEEN	1	N	N	N
PACROSE	41	Y	N	N
PACSEA	47	N	N	N
PACSTAR	66	N	N	Y
PATRIOT	26	N	N	N
PAUL H. TOWNSEND	35	N	N	Y
PAUL R. TREGURTHA	326	Y	N	N
PEGASUS HIGHWAY	18	N	N	N
PEGGY DOW	154	N	N	N
PFC DEWAYNE T. WILLIAM	23	Y	N	N
PFC EUGENE A. OBREGON	18	Y	N	N
PHILADELPHIA	73	Y	N	N
PHILIP R. CLARKE	218	Y	N	Y
PHOENIX DIAMOND	42	Y	Y	Y
PIERRE FORTIN	561	N	N	N
PINO GLORIA	30	N	N	N
PISCES EXPLORER	58	N	N	N
PISCES PIONEER	141	N	N	N
POLAR EAGLE	99	Y	Y	Y
POLYNESIA	374	Y	N	Y
POTOMAC TRADER	78	Y	N	N
POYANG	112	N	N	N
PRESIDENT ADAMS	183	Y	Y	Y
PRESIDENT EISENHOWER	189	Y	Y	Y
PRESIDENT F. ROOSEVELT	218	Y	Y	Y
PRESIDENT JACKSON	120	Y	Y	N
PRESIDENT KENNEDY	268	Y	Y	Y
PRESIDENT POLK	219	Y	Y	Y
PRESIDENT TRUMAN	65	Y	N	Y
PRESQUE ISLE	374	Y	N	Y
PRIDE OF BALTIMORE II	152	Y	N	N
PRINCE OF OCEAN	43	N	N	N
PRINCE OF TOKYO 2	288	Y	N	N
PRINCE WILLIAM SOUND	142	Y	N	N
PRINCESS OF SCANDINAVI	297	N	N	N
PROJECT ORIENT	128	N	N	N
PUERTO CORTES	10	N	N	N
PUSAN SENATOR	22	N	N	N
PYTCHLEY	38	N	N	N
QUEEN ELIZABETH 2	78	N	N	N
QUEEN OF SCANDINAVIA	226	N	N	N
QUEENSLAND STAR	246	N	N	N
R.J. PFEIFFER	128	Y	Y	Y
RANI PADMINI	19	N	N	N
RAYMOND E. GALVIN	78	Y	N	Y
REGAL PRINCESS	15	Y	N	N
REGINA J	86	N	N	N
REPULSE BAY	166	N	N	N
RESERVE	269	Y	N	Y
RESOLUTE	126	N	Y	N
RHINE FOREST	175	Y	N	Y

Continued on Page 76

Continued from Page 75

NAME	TOTAL OBS	MANUSCRIPT RECEIVED APR	MAY	JUN
RICHARD G MATTHIESEN	5	Y	N	N
RICHARD REISS	40	Y	N	Y
ROBERT E. LEE	67	Y	N	Y
ROGER BLOUGH	370	Y	Y	Y
ROGER REVELLE	112	Y	Y	N
ROSINA TOPIC	3	N	N	N
ROSITA	92	Y	Y	Y
ROSSEL CURRENT	279	Y	N	N
ROYAL MAJESTY	19	Y	N	N
ROYAL PRINCESS	55	N	N	N
RUBIN BONANZA	58	Y	N	N
RUBIN KOBE	103	N	N	N
RUBIN PEARL	67	Y	N	N
RUBIN ROSE	111	Y	Y	N
RUBIN STAR	35	Y	N	N
RUBIN STELLA	199	N	N	N
RYNDAM	41	N	N	N
S.T. CRAPO	45	Y	N	Y
SAGA CREST	24	N	N	N
SALOME	22	Y	N	N
SAM HOUSTON	26	Y	N	N
SAMUEL GINN	78	N	Y	N
SAMUEL H. ARMACOST	13	N	N	N
SAMUEL L. COBB	24	Y	Y	N
SAMUEL RISLEY	281	N	N	N
SAN ANTONIO	184	N	Y	Y
SAN FELIPE	4	N	N	N
SAN FERNANDO	64	N	N	N
SAN FRANCISCO	75	N	N	N
SAN ISIDRO	99	N	N	N
SAN MARCOS	53	N	N	N
SAN VINCENTE	115	N	N	N
SANKO LAUREL	105	Y	N	N
SANKO MOON	14	N	N	N
SANTA CHRISTINA	220	N	N	N
SANTA ISABELLALOON	10	N	N	N
SANTORIN 2	469	Y	Y	Y
SARAJEVO EXPRESS	33	N	N	N
SARAMATI	27	N	N	N
SAUDI ABHA	4	N	N	N
SC HORIZON	304	Y	N	Y
SCHACKENBORG	2	N	N	N
SEA COMMERCE	104	Y	Y	N
SEA FLORIDA	96	Y	N	Y
SEA FOX	109	Y	N	N
SEA INITIATIVE	21	N	N	N
SEA ISLE CITY	15	N	N	N
SEA JUSTICE	21	N	N	N
SEA LION	459	Y	Y	N
SEA MAJESTY	51	N	N	Y
SEA MARINER	53	N	N	N
SEA MERCHANT	610	Y	Y	N
SEA NOVIA	38	Y	N	Y
SEA PRINCESS	148	N	Y	Y
SEA RACER	52	N	N	N
SEA SPRAY	10	N	N	N
SEA TRADE	89	N	N	N
SEA WISDOM	108	Y	Y	N
SEA WOLF	126	Y	Y	Y
SEA-LAND CHARGER	79	Y	Y	Y
SEA/LAND VICTORY	114	N	N	N
SEABOARD SUN	53	Y	N	Y
SEABOARD UNIVERSE	77	Y	Y	N
SEABREEZE I	43	Y	N	Y
SEALAND ANCHORAGE	99	Y	Y	Y

NAME	TOTAL OBS	MANUSCRIPT RECEIVED APR	MAY	JUN
SEALAND ATLANTIC	108	Y	Y	Y
SEALAND CHALLENGER	206	Y	Y	Y
SEALAND CHAMPION	111	Y	Y	Y
SEALAND COMET	86	N	Y	Y
SEALAND CONSUMER	68	Y	Y	N
SEALAND CRUSADER	232	Y	N	N
SEALAND DEFENDER	205	N	Y	N
SEALAND DEVELOPER	127	Y	Y	Y
SEALAND DISCOVERY	170	Y	Y	Y
SEALAND ENDURANCE	111	Y	N	Y
SEALAND ENTERPRISE	334	Y	Y	Y
SEALAND EXPEDITION	60	Y	N	N
SEALAND EXPLORER	160	Y	Y	Y
SEALAND EXPRESS	477	Y	Y	Y
SEALAND FREEDOM	352	Y	N	N
SEALAND HAWAII	206	Y	Y	N
SEALAND INDEPENDENCE	132	Y	Y	N
SEALAND INNOVATOR	145	Y	Y	Y
SEALAND INTEGRITY	375	Y	N	N
SEALAND KODIAK	16	Y	N	N
SEALAND LIBERATOR	119	Y	N	N
SEALAND MARINER	311	Y	Y	N
SEALAND MERCURY	122	Y	Y	N
SEALAND METEOR	93	Y	Y	Y
SEALAND NAVIGATOR	306	Y	Y	Y
SEALAND PACER	34	N	N	N
SEALAND PACIFIC	275	Y	Y	Y
SEALAND PATRIOT	85	Y	Y	N
SEALAND PERFORMANCE	335	Y	Y	Y
SEALAND PRODUCER	231	Y	Y	Y
SEALAND QUALITY	89	Y	N	N
SEALAND RACER	85	Y	Y	Y
SEALAND RELIANCE	265	Y	Y	Y
SEALAND SPIRIT	3	N	N	N
SEALAND TACOMA	100	Y	N	Y
SEALAND TRADER	262	Y	Y	Y
SEALAND VOYAGER	226	Y	Y	Y
SEARIVER BATON ROUGE	33	Y	Y	Y
SEARIVER BENICIA	40	Y	Y	Y
SEARIVER LONG BEACH	37	Y	N	N
SEARIVER MEDITERRANEAN	1	N	N	N
SEARIVER NORTH SLOPE	3	N	N	N
SEARIVER SAN FRANCISCO	14	N	N	N
SEAWIND CROWN	214	Y	Y	Y
SEILLEAN	316	N	N	N
SENATOR	8	N	N	N
SENSATION	96	Y	Y	Y
SETO BRIDGE	154	N	N	Y
SEVEN OCEAN	17	N	N	N
SEWARD JOHNSON	131	N	N	N
SGT WILLIAM A BUTTON	16	Y	N	N
SGT. METEJ KOCAK	85	Y	Y	Y
SHELLY BAY	213	Y	Y	Y
SHIRAOI MARU	244	Y	Y	Y
SIBOHELLE	36	N	Y	Y
SIDNEY STAR	173	N	N	N
SIERRA MADRE	25	Y	N	N
SIETE OCEANOS	143	Y	Y	Y
SIGAL	17	Y	N	N
SINCERE GEMINI	30	N	N	N
SINCERE PROMINENCE	9	N	N	N
SINCERE SUCCESS	2	N	N	N
SKAUBRYN	108	N	N	N
SKAUGRAN	28	N	N	N
SKOGAFOSS	106	N	N	N

Continued on Page 77

Continued from Page 76

NAME	TOTAL OBS	MANUSCRIPT RECEIVED		
		APR	MAY	JUN
SKY PRINCESS	43	Y	N	N
SNOW CRYSTAL	161	N	N	N
SOKOLICA	51	Y	Y	N
SOL DO BRASIL	90	Y	Y	N
SOLAR WING	98	N	N	N
SONG OF AMERICA	36	N	N	N
SONORA	370	Y	N	Y
SOREN TOUBRO	225	Y	N	N
SOUTHERN LION	49	N	N	N
SP5. ERIC G. GIBSON	40	Y	Y	N
SPRING BEAR	19	N	N	N
SPRING GANNET	202	Y	Y	Y
SPRING WAVE	71	Y	Y	Y
ST. CLAIR	222	Y	N	Y
STAR ALABAMA	107	Y	Y	N
STAR AMERICA	106	Y	N	N
STAR EAGLE	30	N	N	N
STAR EVVIVA	94	N	N	N
STAR FLORIDA	110	N	N	N
STAR FUJI	90	N	N	N
STAR GRAN	112	Y	Y	N
STAR HANSA	25	N	N	N
STAR HARDANGER	214	Y	Y	Y
STAR HERDLA	49	N	N	N
STAR HOYANGER	10	Y	Y	N
STAR SKARVEN	57	Y	N	Y
STAR SKOGANGER	7	N	N	N
STAR STRONEN	16	N	N	N
STATE OF GUIARAT	4	N	N	N
STATENDAM	51	N	N	N
STELLA LYKES	133	Y	Y	N
STEPAN KRASHENINNIKOV	21	N	N	N
STEPHAN J	455	Y	Y	Y
STEWART J. CORT	145	Y	Y	Y
STOLT CONDOR	17	N	N	N
STOLT HELLULAND	3	N	N	N
STONEWALL JACKSON	170	Y	Y	N
STRONG CAJUN	36	Y	N	N
STRONG ICELANDER	53	N	N	N
STRONG VIRGINIAN	269	N	Y	N
SUGAR ISLANDER	1	N	N	N
SUMMER BREEZE	139	N	N	N
SUMMER MEADOW	36	N	N	N
SUN DANCE	27	N	Y	N
SUN PRINCESS	6	N	N	N
SUNBELT DIXIE	29	N	N	N
SUNDA	103	N	N	N
SUSAN W. HANNAH	267	N	N	Y
SVEN OLTMANN	86	N	N	N
T/V STATE OF MAINE	46	N	N	Y
TADEUSZ OCIOSZYNSKI	1	N	N	N
TAGUS	30	Y	N	N
TAI HE	197	N	N	N
TAI SHING	78	N	Y	N
TAIKO	6	N	N	N
TAKAYAMA	87	Y	N	N
TALABOT	53	N	N	Y
TALLAHASSEE BAY	69	N	N	N
TAMAMIMA	61	N	N	N
TANABATA	27	N	N	N
TARAGO	1	N	N	N
TELLUS	121	Y	Y	N
TEPOZTECO II	54	N	N	N
TEQUI	86	Y	Y	Y
TEXAS CLIPPER	37	N	N	N

NAME	TOTAL OBS	MANUSCRIPT RECEIVED		
		APR	MAY	JUN
THOMAS G. THOMPSON	154	Y	Y	N
TILLIE LYKES	275	Y	Y	Y
TJALDRID	44	N	N	N
TMM MEXICO	165	Y	N	N
TMM VERACRUZ	73	Y	Y	Y
TOKIO EXPRESS	619	N	N	N
TOLUCA	39	N	N	N
TONSINA	144	Y	N	N
TORBEN	15	N	N	N
TORM AMERICA	158	Y	Y	N
TORM FREYA	70	N	Y	Y
TOWER BRIDGE	44	N	N	N
TRADE APOLLO	122	N	N	N
TRANSWORLD BRIDGE	168	Y	Y	Y
TROPIC DAY	14	Y	N	N
TROPIC FLYER	31	Y	Y	N
TROPIC ISLE	59	Y	Y	Y
TROPIC JADE	31	Y	N	Y
TROPIC KEY	104	Y	Y	Y
TROPIC LURE	32	Y	Y	Y
TROPIC SUN	142	Y	Y	Y
TROPIC TIDE	42	Y	Y	Y
TROPICALE	57	N	N	N
TRSL ARCTURUS	25	N	N	N
TRUST 38	112	Y	N	Y
TULSIDAS	1	N	N	N
TURMOIL	55	N	N	N
TYSON LYKES	95	Y	Y	Y
USCGC ACACIA (WLB406)	13	Y	N	N
USCGC ACTIVE WMEC 618	65	Y	N	N
USCGC ACUSHNET WMEC 16	94	N	N	N
USCGC ALERT (WMEC 630)	28	N	N	N
USCGC BOUTWELL WHEC 71	221	Y	N	N
USCGC BRAMBLE (WLB 392	8	N	N	N
USCGC CHASE (WHEC 718)	1	N	N	N
USCGC COURAGEOUS	10	Y	N	N
USCGC DAUNTLESS WMEC 6	66	Y	N	N
USCGC DURABLE (WMEC 62	32	N	N	N
USCGC EAGLE (WIX 327)	7	N	N	N
USCGC FIREBUSH WLB 393	2	N	N	N
USCGC FORWARD	44	N	N	N
USCGC HARRIET LANE	32	N	N	N
USCGC HORNBEAM	4	N	N	N
USCGC IRONWOOD (WLB 29	11	N	N	N
USCGC JARVIS (WHEC 725	202	Y	Y	Y
USCGC LEGARE	22	N	N	N
USCGC MELLON (WHEC 717	28	N	N	N
USCGC MIDGETT (WHEC 72	134	Y	Y	N
USCGC MORGENTHAU	144	Y	Y	N
USCGC PLANETREE	13	N	N	N
USCGC POLAR SEA__(WAGB	718	Y	N	N
USCGC RELIANCE WMEC 61	14	N	N	N
USCGC RUSH	152	Y	N	N
USCGC SEDGE (WLB 402)	14	N	N	N
USCGC SENECA	5	N	N	N
USCGC STEADFAST (WMEC	3	N	N	N
USCGC STORIS (WMEC 38)	55	N	N	N
USCGC SUNDEW (WLB 404)	22	Y	N	N
USCGC SWEETBRIER WLB 4	18	Y	N	N
USCGC TAHOMA	111	Y	Y	N
USCGC VALIANT (WMEC 62	38	N	N	Y
USCGC VENTUROUS WMEC 6	13	N	N	N
USCGC VIGOROUS WMEC 62	70	Y	N	N
USCGC WOODRUSH (WLB 40	17	N	N	N
USNS ALGOL	39	Y	N	N

Continued on Page 78

VOS Cooperative Ship Reports

Continued from Page 77

NAME	TOTAL OBS	MANUSCRIPT RECEIVED APR	MAY	JUN
USNS APACHE (T-ATF 172	41	N	Y	Y
USNS CAPELLA	108	Y	Y	N
USNS CONCORD	114	Y	Y	N
USNS GUS W. DARNELL	18	N	N	N
USNS HAYES	18	Y	N	N
USNS JOHN MCDONNELL (T	187	Y	Y	Y
USNS KANE TAGS 27	80	Y	N	Y
USNS LARAMIE T-AO 203	127	Y	Y	Y
USNS PATHFINDER T-AGS	24	Y	N	N
USNS PATUXENT	216	Y	Y	Y
USNS PECOS	504	Y	N	Y
USNS SATURN T-AFS-10	113	N	Y	Y
USNS SIRIUS (T-AFS 8)	158	Y	N	N
USNS SUMNER	182	Y	Y	Y
USNS VANGUARD TAG 194	153	Y	Y	N
VASILTY BURKHANOV	45	N	N	N
VEENDAM	4	N	N	N
VEGA	54	N	N	N
VENUS DIAMOND	8	N	N	N
VERA ACORDE	285	N	N	N
VICTORIA	96	N	N	N
VIRGINIA	343	Y	Y	Y
VISAYAN GLORY	28	N	N	N
VIVA	163	Y	Y	Y
WALTER J. MCCARTHY	30	Y	N	Y
WASHINGTON HIGHWAY	111	N	N	N
WASHINGTON SENATOR	78	N	N	N
WESTERN LION	96	N	N	N
WESTWARD	22	N	N	N
WESTWARD VENTURE	383	Y	Y	Y
WESTWOOD ANETTE	121	Y	Y	Y
WESTWOOD BELINDA	277	N	N	N
WESTWOOD CLEO	130	Y	Y	Y
WESTWOOD FUJI	352	Y	Y	Y
WESTWOOD HALLA	197	N	N	N
WESTWOOD JAGO	101	Y	Y	N
WESTWOOD MARIANNE	92	Y	Y	N
WILFRED SYKES	211	Y	Y	Y
WILLIAM E. CRAIN	125	N	Y	Y
WILLIAM E. MUSSMAN	149	Y	Y	Y
WOLVERINE	115	Y	N	Y
YUCATAN	226	N	N	N
YURIY OSTROVSKIY	332	Y	N	Y
ZENITH	23	N	N	N
ZETLAND	64	N	N	N
ZIM ADRIATIC	82	N	N	N
ZIM AMERICA	54	N	N	N
ZIM ASIA	117	N	N	N
ZIM ATLANTIC	70	N	N	N
ZIM CANADA	98	N	N	N
ZIM EUROPA	71	N	N	N
ZIM ISRAEL	75	N	N	N
ZIM ITALIA	80	N	N	N
ZIM JAMAICA	125	N	N	N
ZIM JAPAN	107	N	N	N
ZIM KEELUNG	59	N	N	N
ZIM KOREA	103	N	N	N
ZIM MONTEVIDEO	23	N	N	N
ZIM SANTOS	147	Y	Y	Y
GRAND TOTAL	18697			

NAME	TOTAL OBS	MANUSCRIPT RECEIVED JUL	AUG	SEP
1ST LT ALEX BONNYMAN	120	N	Y	N
1ST LT BALDOMERO LOPEZ	65	N	N	N
ACADIA FOREST	166	Y	Y	Y
ADAM E. CORNELIUS	33	Y	Y	N
ADVANTAGE	80	Y	N	N
AGDLEK	104	N	N	N
AGULHAS	104	Y	Y	N
AL FUNTAS	39	N	N	N
ALBEMARLE ISLAND	223	N	Y	Y
ALDEN W. CLAUSEN	134	Y	Y	Y
ALEXANDER VON HUMBOLD	141	N	N	N
ALLEGIANCE	132	Y	Y	Y
ALLIGATOR BRAVERY	197	Y	Y	Y
ALLIGATOR COLUMBUS	143	N	Y	Y
ALLIGATOR GLORY	31	Y	Y	Y
ALLIGATOR STRENGTH	155	Y	Y	Y
ALMERIA LYKES	99	Y	Y	Y
ALPENA	139	Y	Y	Y
ALTAIR	857	N	N	N
AMAZON	73	Y	Y	N
AMBASSADOR BRIDGE	242	Y	N	Y
AMER HIMALAYA	2	N	N	N
AMERICAN CONDOR	228	Y	Y	Y
AMERICAN CORMORANT	99	N	N	N
AMERICAN FALCON	113	Y	Y	Y
AMERICAN MERLIN	55	Y	N	N
AMERICANA	42	Y	Y	Y
AMERIGO VESPUCCI	22	Y	N	N
ANAHUAC	60	N	N	N
ANASTASIS	4	N	N	N
ANDERS MAERSK	230	Y	N	Y
ANKERGRACHT	45	N	N	N
ANNA MAERSK	149	Y	Y	Y
APL CHINA	145	N	N	N
APL JAPAN	280	Y	Y	Y
APL PHILIPPINES	125	N	N	N
APL THAILAND	128	N	N	N
ARABIAN SEA	46	Y	Y	Y
ARCO ALASKA	48	Y	N	Y
ARCO ANCHORAGE	3	N	N	N
ARCO CALIFORNIA	33	N	Y	N
ARCO FAIRBANKS	32	Y	Y	Y
ARCO INDEPENDENCE	73	Y	N	N
ARCO JUNEAU	29	Y	Y	Y
ARCO PRUDHOE BAY	7	N	N	N
ARCO SAG RIVER	48	N	N	Y
ARCO SPIRIT	65	N	N	Y
ARCO TEXAS	60	Y	N	N
ARCTIC OCEAN	197	N	Y	Y
ARCTIC SUN	136	Y	Y	Y
ARGONAUT	127	Y	Y	Y
ARIES	133	Y	Y	N
ARINA ARCTICA	271	N	N	N
ARKTIS LIGHT	126	N	N	N
ARKTIS SPRING	161	Y	Y	Y
ARMCO	201	Y	Y	Y
ARTHUR M. ANDERSON	210	Y	Y	N
ARTHUR MAERSK	117	Y	N	N
ASPHALT COMMANDER	21	Y	N	N
ATLANTIC	654	N	N	N
ATLANTIC BULKER	81	N	N	N
ATLANTIC CARTIER	40	N	N	N
ATLANTIS	51	N	N	N
AUSTRAL RAINBOW	93	N	Y	N
AXEL MAERSK	199	Y	Y	Y

Continued on Page 79

Continued from Page 78

NAME	TOTAL OBS	MANUSCRIPT RECEIVED		
		JUL	AUG	SEP
B. T. ALASKA	78	Y	Y	N
BAAB ULLAH	1	N	N	N
BANDA SEAHORSE	220	Y	N	N
BARBARA ANDRIE	62	N	Y	N
BARBICAN SPIRIT	81	N	N	N
BARRINGTON ISLAND	279	Y	N	Y
BAY BRIDGE	51	Y	Y	Y
BELGRANO	139	N	N	N
BERNARDO QUINTANA A	81	N	Y	Y
BLOSSOM FOREVER	183	N	N	N
BLUE GEMINI	113	Y	Y	Y
BLUE NOVA	101	Y	N	N
BOHINJ	1	N	N	N
BOSPORUS BRIDGE	193	Y	Y	Y
BOW TRIGGER	99	N	N	N
BRIGHT PHOENIX	161	Y	Y	N
BRIGIT MAERSK	133	N	N	N
BROOKLYN BRIDGE	172	N	N	N
BRUCE SMART	61	Y	N	N
BUCKEYE	201	Y	Y	N
BUNGA ORKID DUA	65	Y	Y	N
BUNGA SAGA DUA	3	N	N	N
BUNGA SAGA TIGA	203	Y	Y	Y
BURNS HARBOR	462	Y	Y	N
CABO TAMAR	85	N	N	N
CALCITE II	287	Y	Y	Y
CALIFORNIA CURRENT	109	N	N	N
CALIFORNIA JUPITER	242	N	N	Y
CALIFORNIA PEGASUS	37	N	N	N
CALIFORNIA SATURN	39	N	N	N
CALIFORNIA ZEUS	199	N	Y	Y
CANBERRA	41	N	N	N
CAPE BREEZE	22	N	N	N
CARIBBEAN MERCY	11	N	N	Y
CARLA A. HILLS	160	Y	N	N
CASON J. CALLAWAY	256	Y	Y	Y
CELEBRATION	108	Y	Y	Y
CENTURY	28	N	N	N
CENTURY HIGHWAY #2	45	N	N	N
CHARLES E. WILSON	69	Y	Y	Y
CHARLES ISLAND	132	N	Y	Y
CHARLES LYKES	177	N	N	N
CHARLES M. BEEGHLEY	188	Y	Y	Y
CHARLES PIGOTT	183	Y	Y	Y
CHASTINE MAERSK	61	Y	Y	N
CHELSEA	165	Y	Y	Y
CHEMBULK FORTITUDE	109	N	N	N
CHEMICAL PIONEER	232	N	Y	N
CHESAPEAKE TRADER	154	Y	N	N
CHEVRON ARIZONA	2	N	N	N
CHEVRON ATLANTIC	174	Y	N	Y
CHEVRON COLORADO	177	Y	Y	Y
CHEVRON EDINBURGH	244	N	Y	Y
CHEVRON EMPLOYEE PRIDE	14	N	N	N
CHEVRON FELUY	77	N	N	N
CHEVRON MISSISSIPPI	108	Y	Y	Y
CHEVRON NAGASAKI	148	Y	Y	Y
CHEVRON PERTH	56	N	N	N
CHEVRON SOUTH AMERICA	137	N	Y	Y
CHIEF GADAO	172	Y	Y	Y
CHILEAN EXPRESS	5	N	N	N
CHINA HOPE	13	N	N	N
CHIQUITA BREMEN	123	N	N	N
CHIQUITA BRENDA	229	N	N	N
CHIQUITA ELKESCHLAND	196	N	N	N

NAME	TOTA OBS	MANUSCRIPT RECEIVED		
		JUL	AUG	SEP
CHIQUITA FRANCES	168	N	N	N
CHIQUITA ITALIA	90	N	N	N
CHIQUITA JEAN	78	N	N	N
CHIQUITA JOY	103	N	N	N
CHIQUITA ROSTOCK	148	N	N	N
CHO YANG ATLAS	60	N	N	N
CHOYANG VISION	269	N	N	Y
CIELO DI FIRENZE	85	Y	N	N
CLEVELAND	172	N	N	N
CLIFFORD MAERSK	11	N	N	N
CMS ISLAND EXPRESS	33	Y	Y	Y
COLUMBIA BAY	53	N	N	N
COLUMBIA STAR	269	Y	Y	Y
COLUMBINE	230	N	N	N
COLUMBUS AMERICA	115	N	N	N
CONTSHIP HOUSTON	33	N	N	N
COPACABANA	87	N	N	Y
CORDELIA	52	Y	N	N
CORMORANT ARROW	5	N	N	N
CORNUCOPIA	11	N	N	N
CORPUS CHRISTI	230	Y	N	N
CORWITH CRAMER	121	Y	N	N
COSMOWAY	29	N	N	Y
COURIER	71	N	N	N
COURTNEY BURTON	241	Y	Y	Y
COURTNEY L	36	N	N	N
CPL. LOUIS J. HAUGE JR	74	N	N	N
CRISTOFORO COLOMBO	15	N	N	N
CROWN PRINCESS	48	Y	N	N
CSAV RELONCAVI	2	N	N	N
CSK UNITY	85	N	N	N
CSL ATLAS	26	N	N	N
CSL CABO	105	N	N	N
DAISHIN MARU	92	N	N	N
DAN MOORE	3	N	N	N
DANIA PORTLAND	94	N	N	N
DARYA PREETH	54	N	N	N
DAVID Z. NORTON	6	N	N	Y
DAWN PRINCESS	10	N	N	N
DELAWARE TRADER	255	N	N	N
DENALI	277	N	N	N
DESTINY	360	Y	Y	Y
DG COLUMBIA	281	Y	Y	N
DIAMOND STAR	5	N	N	N
DIRCH MAERSK	118	N	Y	Y
DIRECT EAGLE	74	N	N	N
DIRECT FALCON	151	N	N	N
DIRECT KEA	142	N	N	N
DIRECT KIWI	268	N	N	Y
DIRECT KOOKABURRA	102	Y	Y	Y
DOCTOR LYKES	243	Y	N	Y
DORTHE OLDENDORFF	272	N	N	Y
DUCHESS	16	N	N	Y
DUHALLOW	228	N	N	N
DUNCAN ISLAND	167	Y	N	N
EAGLE BOSTON	12	N	N	N
EARL W. OGLEBAY	5	Y	N	N
ECSTASY	190	N	Y	Y
EDELWIESS	134	N	N	N
EDGAR B. SPEER	256	Y	Y	N
EDWIN H. GOTT	619	N	Y	Y
EDYTH L	33	N	N	N
ELISE SHULTE	60	N	N	N
ELLEN KNUDSEN	1	N	N	N
ELLIOTT BAY	248	Y	N	Y

Continued on Page 80

Continued from Page 79

NAME	TOTAL OBS	MANUSCRIPT RECEIVED JUL	AUG	SEP
ELTON HOYT II	72	Y	N	Y
EMPIRE STATE	44	N	N	N
EQUATORIAL LION	76	N	N	N
EQUINOX	57	N	N	N
EVER GAINING	5	N	N	N
EVER GARDEN	7	N	N	N
EVER GATHER	17	N	N	N
EVER GENERAL	6	N	N	N
EVER GENTRY	21	N	N	N
EVER GUARD	9	N	N	N
EVER GUEST	8	N	N	N
EVER LEVEL	26	N	N	N
EVER LYRIC	30	Y	N	N
EVER RACER	17	N	N	N
EVER REPUTE	4	N	N	N
EVER RESULT	23	N	N	N
EVER ULTRA	97	N	N	N
EVER UNION	87	Y	N	N
EVER UNIQUE	38	N	N	Y
EVER UNISON	178	N	N	N
EVER UNITED	2	N	N	N
EXCELSIOR	130	N	N	N
EXPORT PATRIOT	199	N	Y	Y
FANAL TRADER	243	Y	Y	Y
FANTASY	44	Y	N	Y
FARALLON ISLAND	731	N	N	N
FASCINATION	94	Y	N	Y
FAUST	174	Y	N	Y
FERNCROFT	161	Y	N	Y
FIDELIO	272	N	N	N
FOREST TRADER	63	N	N	N
FRANCES HAMMER	98	N	N	N
FRANCES L.	74	N	N	N
FRED R. WHITE JR	39	N	N	Y
GALAXY ACE	28	N	N	N
GALVESTON BAY	228	Y	Y	Y
GEETA	12	N	N	N
GEORGE A. SLOAN	295	Y	Y	Y
GEORGE A. STINSON	110	Y	Y	Y
GEORGE H. WEYERHAEUSER	110	Y	N	N
GEORGE SCHULTZ	128	Y	Y	Y
GEORGIA RAINBOW II	82	N	N	N
GLOBAL MARINER	33	Y	N	N
GLORIOUS SUCCESS	54	Y	N	N
GLORIOUS SUN	182	Y	Y	N
GOLDEN BELL	15	N	N	N
GOLDEN GATE	213	N	N	Y
GOLDEN GATE BRIDGE	170	Y	Y	Y
GOPHER STATE	1	N	N	N
GREAT LAND	139	Y	Y	Y
GREEN BAY	132	Y	N	N
GREEN ISLAND	42	Y	N	N
GREEN LAKE	232	Y	Y	Y
GREEN MAYA	38	N	N	N
GREEN RAINIER	21	N	N	N
GREEN RIDGE	92	N	Y	N
GREEN SASEBO	82	Y	Y	Y
GRETKE OLDENDORFF	36	N	N	N
GROTON	90	Y	Y	Y
GUANAJUATO	190	Y	Y	N
GUAYAMA	372	N	Y	Y
GULF CURRENT	244	N	N	N
GYPSUM KING	138	N	N	N
H. LEE WHITE	4	N	N	Y
HADERA	9	N	N	N

NAME	TOTAL OBS	MANUSCRIPT RECEIVED JUL	AUG	SEP
HANJIN BARCELONA	12	N	N	N
HANJIN BREMEN	4	N	N	N
HANJIN FELIXSTOWE	11	N	N	N
HANJIN KAOHSIUNG	11	N	N	N
HANJIN LE HAVRE	22	N	N	N
HANJIN OAKLAND	7	N	N	N
HANJIN PORTLAND	21	N	N	N
HANJIN SHANGHAI	29	N	N	N
HANJIN SINGAPORE	8	N	N	N
HANJIN TOKYO	4	N	N	N
HANSA CARRIER	22	N	N	N
HARBOUR BRIDGE	61	N	Y	N
HEICON	34	N	N	N
HELVETIA	62	Y	N	N
HERBERT C. JACKSON	73	N	N	N
HOEGH CLIPPER	4	N	N	N
HOEGH DYKE	28	N	N	N
HOEGH MERIT	159	N	N	N
HOEGH MINERVA	18	Y	N	N
HOLCK LARSEN	2	N	N	N
HONSHU SILVIA	98	Y	N	N
HOOD ISLAND	102	N	N	N
HOUSTON	157	N	N	N
HUAL INGRITA	2	N	N	N
HUAL ROLITA	14	N	N	N
HUMACAO	300	Y	Y	Y
HYUNDAI DISCOVERY	131	N	N	N
HYUNDAI DYNASTY	147	N	N	N
HYUNDAI FIDELITY	166	N	Y	N
HYUNDAI FORTUNE	80	N	N	N
HYUNDAI FREEDOM	53	N	N	N
HYUNDAI INDEPENDENCE	112	N	N	N
HYUNDAI LIBERTY	23	N	N	N
IMAGINATION	83	Y	Y	Y
INDIANA HARBOR	294	Y	Y	Y
INLAND SEAS	19	Y	Y	N
INSPIRATION	106	Y	Y	Y
IOWA TRADER	56	N	N	N
IRENA ARCTICA	294	N	N	N
ISLA DE CEDROS	46	N	N	N
ISLA GRAN MALVINA	6	N	N	N
ISLAND BREEZE	29	N	N	N
ITB BALTIMORE	77	Y	Y	Y
ITB MOBILE	109	N	Y	Y
ITB NEW YORK	51	Y	Y	Y
IWANUMA MARU	250	N	Y	N
J. DENNIS BONNEY	117	N	Y	Y
JACKLYN M.	63	Y	Y	N
JACKSONVILLE	152	N	Y	Y
JADE ORIENT	4	N	N	N
JADE PACIFIC	23	N	N	N
JALAGOVIND	10	N	N	N
JAMES N. SULLIVAN	6	N	N	N
JAMES R. BARKER	231	Y	Y	Y
JEB STUART	15	N	N	N
JOHN G. MUNSON	324	Y	Y	Y
JOHN J. BOLAND	116	Y	Y	Y
JOHN YOUNG	84	Y	N	N
JOIDES RESOLUTION	139	Y	N	N
JOSEPH H. FRANTZ	92	Y	Y	Y
JOSEPH L. BLOCK	134	Y	Y	N
JUBILANT	11	N	N	N
JULIUS HAMMER	133	Y	N	N
KAIJIN	1	N	N	N
KANSAS TRADER	216	N	N	N

Continued on Page 81

Continued from Page 80

NAME	TOTAL OBS	MANUSCRIPT RECEIVED JUL	AUG	SEP
KAPITAN BYANKIN	124	Y	Y	Y
KAPITAN KONEV	251	Y	Y	N
KAPITAN SERYKH	152	Y	Y	Y
KAREN ANDRIE	96	Y	Y	N
KAUAI	526	Y	Y	Y
KAYE E. BARKER	202	Y	Y	Y
KEE LUNG	14	N	N	N
KELLIE CHOUEST	2	N	Y	N
KEN KOKU	56	N	N	N
KEN SHIN	152	Y	Y	Y
KENAI	56	N	Y	Y
KENNETH E. HILL	220	Y	Y	Y
KENNETH T. DERR	104	Y	Y	N
KINSMAN INDEPENDENT	329	Y	Y	Y
KOMET	95	Y	Y	Y
KURE	140	Y	Y	Y
LA ESPERANZA	93	N	N	N
LAKE CHARLES	123	Y	Y	N
LAKE GUARDIAN	35	N	N	N
LAUST MAERSK	33	N	N	Y
LAWRENCE H. GIANELLA	28	N	N	N
LEE A. TREGURTHA	60	Y	Y	Y
LEOPARDI	24	N	N	N
LIBERTY STAR	198	N	N	N
LIBERTY SUN	43	N	N	N
LIBERTY WAVE	22	N	N	N
LIHUE	200	Y	Y	Y
LINDA OLDENDORF	54	N	N	N
LIRCAY	20	Y	N	N
LNG AQUARIUS	266	Y	Y	Y
LNG CAPRICORN	22	Y	N	N
LNG LEO	76	Y	Y	N
LNG LIBRA	40	N	Y	N
LNG TAURUS	193	Y	Y	N
LNG VIRGO	181	Y	Y	Y
LOK PRAGATI	114	N	N	N
LONG BEACH	195	N	Y	Y
LOUIS MAERSK	22	N	Y	N
LT ARGOSY	21	N	N	N
LT. ODYSSEY	4	N	N	N
LTC CALVIN P. TITUS	68	N	N	N
LUCY OLDENDORFF	11	N	N	N
LUISE OLDENDORFF	174	N	N	N
LURLINE	17	N	N	N
LYKES EXPLORER	202	Y	Y	Y
MAASDAM	11	N	N	N
MACKINAC BRIDGE	210	N	N	N
MADISON MAERSK	77	Y	N	N
MAERSK CALIFORNIA	205	N	Y	Y
MAERSK CONSTELLATION	321	N	Y	N
MAERSK ENDEAVOUR	560	N	N	N
MAERSK EXPLORER	474	N	N	N
MAERSK GANNET	81	N	N	N
MAERSK GIANT	688	N	N	N
MAERSK QUITO	1	N	N	N
MAERSK RIO GRANDE	18	N	N	N
MAERSK STAFFORD	89	N	N	N
MAERSK SUN	107	Y	N	Y
MAERSK TACOMA	12	N	N	N
MAERSK TENNESSEE	34	N	N	N
MAERSK TEXAS	126	N	N	N
MAGLEBY MAERSK	57	N	N	N
MAHARASHTRA	32	N	N	N
MAHIMAHI	162	Y	Y	N
MAJ STEPHEN W PLESS MP	103	Y	Y	N

NAME	TOTAL OBS	MANUSCRIPT RECEIVED JUL	AUG	SEP
MAJESTIC MAERSK	117	Y	Y	Y
MANGAL DESAI	8	N	N	N
MANOA	469	Y	Y	Y
MANUKAI	172	Y	Y	Y
MANULANI	91	Y	Y	N
MARCARRIER	1	N	N	N
MARCHEN MAERSK	107	Y	Y	Y
MAREN MAERSK	92	N	N	Y
MARGARET LYKES	159	Y	Y	Y
MARGRETHE MAERSK	96	Y	Y	Y
MARI BETH ANDRIE	78	Y	Y	Y
MARIE MAERSK	153	N	Y	Y
MARIT MAERSK	92	Y	Y	N
MARK HANNAH	107	Y	Y	N
MARLIN	146	N	Y	Y
MARSTA MAERSK	71	Y	Y	N
MATHILDE MAERSK	143	Y	Y	Y
MATSONIA	417	Y	Y	Y
MAUI	227	Y	Y	N
MAURICE EWING	129	N	N	N
MAYAGUEZ	368	Y	Y	Y
MAYVIEW MAERSK	110	Y	Y	Y
MC-KINNEY MAERSK	102	Y	Y	Y
MEDALLION	45	N	N	N
MEDUSA CHALLENGER	377	Y	Y	Y
MELVILLE	63	N	N	N
MERCHANT PRINCIPAL	3	N	N	N
MERIDIAN	67	Y	Y	Y
MERLION ACE	54	Y	Y	Y
MESABI MINER	300	N	Y	Y
METTE MAERSK	146	N	Y	Y
MICHIGAN	264	Y	N	N
MIDDLETOWN	95	Y	Y	Y
MING ASIA	14	N	N	N
MING PLEASURE	61	N	N	N
MING PROPITIOUS	26	N	N	N
MITLA	5	N	N	N
MOANA PACIFIC	2	N	N	N
MOANA WAVE	130	N	N	N
MOKIHANA	190	Y	Y	Y
MOKU PAHU	65	Y	N	Y
MORELOS	343	N	N	N
MORMACSKY	19	N	N	N
MORMACSTAR	270	N	N	N
MORMACSUN	43	Y	Y	Y
MOSEL ORE	359	Y	N	N
MSC JESSICA	34	N	N	N
MUNKEBO MAERSK	179	Y	N	Y
MYRON C. TAYLOR	321	Y	Y	Y
MYSTIC	130	N	N	N
NATIONAL DIGNITY	30	N	N	N
NATIONAL HONOR	41	N	N	Y
NATIONAL PRIDE	51	Y	N	Y
NEDLLOYD ABIDJAN	174	Y	Y	Y
NEDLLOYD HOLLAND	214	N	Y	N
NEDLLOYD MONTEVIDEO	74	N	N	N
NEGO LOMBOK	136	N	N	N
NELVANA	106	Y	N	N
NEPTUNE RHODONITE	53	N	N	N
NEW CARISSA	94	N	N	N
NEW HORIZON	51	N	N	Y
NEW NIKKI	185	Y	Y	Y
NEWARK BAY	267	N	Y	Y
NEWPORT BRIDGE	50	N	N	N
NOAA DAVID STARR JORDA	44	N	N	N

Continued on Page 82

Continued from Page 81

NAME	TOTAL OBS	MANUSCRIPT RECEIVED		
		JUL	AUG	SEP
NOAA SHIP ALBATROSS IV	405	N	N	N
NOAA SHIP CHAPMAN	406	Y	Y	N
NOAA SHIP DELAWARE II	263	Y	N	N
NOAA SHIP FERREL	453	N	N	N
NOAA SHIP KA'IMIMOANA	589	Y	N	N
NOAA SHIP MCARTHUR	151	Y	Y	Y
NOAA SHIP MILLER FREEM	537	Y	Y	Y
NOAA SHIP OREGON II	463	Y	Y	Y
NOAA SHIP RAINIER	243	Y	Y	Y
NOAA SHIP T. CROMWELL	636	Y	N	Y
NOAA SHIP WHITING	517	N	Y	N
NOBEL STAR	49	N	N	N
NOL AMBER	11	N	N	N
NOMZI	488	N	N	Y
NORD JAHRE TRANSPORTER	14	N	N	N
NORD PARTNER	115	N	Y	Y
NORDMAX	481	Y	N	N
NORDMORITZ	162	N	N	N
NORTHERN LIGHTS	267	Y	Y	Y
NORTHERN LION	67	Y	N	N
NORWAY	18	N	N	N
NUEVO LEON	126	N	N	N
NUEVO SAN JUAN	183	Y	Y	Y
OCEAN CAMELLIA	323	Y	Y	N
OCEAN CITY	140	N	Y	N
OCEAN CLIPPER	282	Y	Y	Y
OCEAN HARMONY	56	Y	Y	N
OCEAN LAUREL	57	N	N	N
OCEAN ORCHID	19	N	N	N
OCEAN SERENE	129	Y	N	Y
OLEANDER	268	N	N	Y
OLIVEBANK	123	N	N	N
OLIVIA	9	N	N	N
OLYMPIAN HIGHWAY	11	N	N	N
OMI COLUMBIA	75	N	N	N
OOCL AMERICA	121	N	Y	Y
OOCL CALIFORNIA	58	N	N	N
OOCL CHINA	135	Y	Y	N
OOCL ENVOY	63	N	N	N
OOCL FAIR	114	N	N	N
OOCL FAME	63	N	N	Y
OOCL FIDELITY	108	Y	N	Y
OOCL FORTUNE	314	N	N	Y
OOCL FRONTIER	44	N	N	N
OOCL HONG KONG	158	Y	N	Y
OOCL INNOVATION	353	N	Y	Y
OOCL INSPIRATION	245	N	Y	N
ORANGE BLOSSOM	18	N	N	N
ORANGE WAVE	14	N	N	N
ORIANA	84	N	N	N
ORIENTE GRACE	33	N	N	N
ORIENTE HOPE	166	Y	Y	Y
ORIENTE NOBLE	42	N	Y	Y
ORIENTE PRIME	48	N	Y	N
OURO DO BRASIL	139	N	N	N
OVERSEAS ALASKA	47	Y	Y	Y
OVERSEAS ARCTIC	78	Y	Y	Y
OVERSEAS CHICAGO	138	Y	Y	N
OVERSEAS HARRIET	57	N	N	N
OVERSEAS JOYCE	165	Y	Y	N
OVERSEAS JUNEAU	35	N	Y	Y
OVERSEAS MARILYN	147	Y	N	Y
OVERSEAS NEW ORLEANS	104	N	N	N
OVERSEAS NEW YORK	31	N	N	N
OVERSEAS OHIO	256	Y	N	Y
OVERSEAS VIVIAN	2	N	N	N
OVERSEAS WASHINGTON	123	N	Y	N
PACASIA	50	N	N	N
PACDUKE	69	N	N	N
PACIFIC HIRO	71	N	Y	Y
PACIFIC HOPE	36	Y	N	N
PACIFIC RAINBOW II	12	N	N	N
PACIFIC SANDPIPER	176	N	N	N
PACMERCHANT	31	N	N	N
PACPRINCE	1	N	N	N
PACROSE	139	N	Y	Y
PACSEA	27	N	N	N
PACSTAR	183	Y	N	Y
PAUL BUCK	103	N	N	N
PAUL R. TREGURTHA	356	Y	Y	Y
PFC EUGENE A. OBREGON	93	N	Y	N
PFC JAMES ANDERSON JR	23	N	Y	N
PFC WILLIAM B. BAUGH	120	N	N	Y
PHILADELPHIA	110	Y	Y	N
PHILIP R. CLARKE	235	Y	N	Y
PHOENIX DIAMOND	81	N	Y	Y
PINO GLORIA	102	N	Y	N
PISCES EXPLORER	81	N	N	N
POLAR EAGLE	130	Y	Y	Y
POLYNESIA	269	Y	Y	N
POROS	2	N	N	N
POTOMAC TRADER	101	N	N	N
PRESIDENT ADAMS	182	Y	Y	Y
PRESIDENT EISENHOWER	253	Y	Y	Y
PRESIDENT F. ROOSEVELT	138	Y	Y	N
PRESIDENT JACKSON	381	Y	Y	Y
PRESIDENT KENNEDY	108	N	N	N
PRESIDENT POLK	179	Y	Y	Y
PRESIDENT TRUMAN	90	Y	Y	Y
PRESQUE ISLE	296	Y	Y	Y
PRIDE OF BALTIMORE II	223	N	Y	N
PRINCE OF OCEAN	149	Y	Y	Y
PRINCE OF TOKYO 2	370	Y	Y	N
PRINCE WILLIAM SOUND	88	N	Y	Y
PUDONG SENATOR	59	N	N	N
PUERTO CORTES	35	N	N	N
PUSAN SENATOR	51	N	N	N
R. HAL DEAN	7	N	N	N
R.J. PFEIFFER	127	Y	N	N
RANI PADMINI	25	N	N	N
RAYMOND E. GALVIN	61	N	N	Y
REBECCA LYNN	115	N	Y	Y
REGINA J	10	N	N	N
RESERVE	201	Y	Y	N
RESOLUTE	124	Y	Y	Y
RHINE FOREST	173	Y	Y	Y
RICHARD G MATTHIESEN	10	N	N	N
RICHARD REISS	11	N	N	N
ROBERT E. LEE	24	N	N	N
ROGER BLOUGH	262	Y	Y	Y
ROGER REVELLE	90	N	N	N
RONALD H. BROWN	402	Y	Y	Y
ROSINA TOPIC	20	N	N	N
ROSITA	39	N	N	Y
ROSSEL CURRENT	264	N	N	N
ROVER	4	N	N	N
ROYAL ETERNITY	7	N	N	N
ROYAL MAJESTY	15	Y	N	N
RUBIN BONANZA	87	N	Y	Y
RUBIN KOBE	415	N	N	Y

Continued on Page 83

Continued from Page 82

NAME	TOTAL OBS	MANUSCRIPT RECEIVED JUL	AUG	SEP
RUBIN PEARL	74	N	N	N
RUBIN STAR	22	N	N	N
RUBIN STELLA	56	N	N	N
RYNDAM	3	N	N	N
S.T. CRAPO	20	N	N	N
SAGA CREST	8	N	N	N
SALOME	115	N	N	N
SAM HOUSTON	202	N	N	Y
SAMUEL H. ARMACOST	185	N	N	Y
SAMUEL L. COBB	24	Y	N	N
SAN ANTONIO	153	Y	Y	Y
SAN MARCOS	289	Y	N	N
SANKO LAUREL	112	N	N	N
SANKO MOON	24	N	N	N
SANTA CHRISTINA	164	N	N	N
SANTA ISABELLALOON	16	N	N	N
SANTORIN 2	358	N	Y	N
SARAMATI	25	N	N	N
SAUDI ABHA	12	N	N	N
SC HORIZON	233	Y	Y	Y
SCHACKENBORG	24	N	N	N
SEA COMMERCE	64	N	N	N
SEA FLORIDA	142	Y	N	Y
SEA FOX	357	Y	N	Y
SEA ISLE CITY	63	Y	N	N
SEA LION	473	Y	Y	N
SEA LYNX	128	N	N	N
SEA MAJESTY	162	Y	Y	N
SEA MARINER	116	N	N	N
SEA NOVIA	31	Y	N	Y
SEA PRINCESS	136	N	N	Y
SEA RACER	324	N	N	Y
SEA TRADE	18	N	N	N
SEA WISDOM	95	N	N	N
SEA WOLF	260	N	Y	N
SEA-LAND CHARGER	155	Y	Y	Y
SEA-LAND EAGLE	102	N	N	N
SEABOARD SUN	53	Y	Y	Y
SEABOARD UNIVERSE	130	Y	N	N
SEABREEZE I	25	Y	N	N
SEALAND ANCHORAGE	146	Y	Y	Y
SEALAND ATLANTIC	70	N	Y	Y
SEALAND CHALLENGER	146	Y	Y	Y
SEALAND CHAMPION	152	Y	Y	Y
SEALAND COMET	112	N	Y	Y
SEALAND CONSUMER	78	Y	N	N
SEALAND CRUSADER	238	Y	Y	Y
SEALAND DEFENDER	168	N	Y	Y
SEALAND DEVELOPER	135	Y	Y	Y
SEALAND DISCOVERY	131	Y	Y	Y
SEALAND ENDURANCE	74	Y	Y	Y
SEALAND ENTERPRISE	369	Y	Y	Y
SEALAND EXPEDITION	212	Y	Y	N
SEALAND EXPLORER	180	Y	Y	N
SEALAND EXPRESS	90	N	Y	Y
SEALAND FREEDOM	439	N	N	Y
SEALAND HAWAII	124	N	N	N
SEALAND INDEPENDENCE	252	Y	Y	Y
SEALAND INNOVATOR	148	Y	N	N
SEALAND INTEGRITY	345	N	Y	N
SEALAND KODIAK	39	N	Y	N
SEALAND LIBERATOR	267	N	N	Y
SEALAND MARINER	198	N	N	Y
SEALAND MERCURY	179	Y	Y	Y
SEALAND METEOR	135	N	Y	Y

NAME	TOTAL OBS	MANUSCRIPT RECEIVED JUL	AUG	SEP
SEALAND NAVIGATOR	290	Y	Y	Y
SEALAND PACER	40	N	N	N
SEALAND PACIFIC	335	Y	Y	Y
SEALAND PATRIOT	237	Y	Y	Y
SEALAND PERFORMANCE	129	Y	Y	N
SEALAND PRODUCER	259	Y	Y	Y
SEALAND QUALITY	252	Y	Y	Y
SEALAND RACER	99	Y	Y	Y
SEALAND RELIANCE	242	Y	Y	Y
SEALAND SPIRIT	65	N	Y	N
SEALAND TACOMA	119	Y	Y	Y
SEALAND TRADER	230	Y	Y	Y
SEALAND VOYAGER	199	Y	Y	Y
SEARIVER BATON ROUGE	16	N	Y	Y
SEARIVER BENICIA	47	Y	Y	Y
SEARIVER LONG BEACH	29	N	Y	Y
SEARIVER NORTH SLOPE	9	N	N	N
SEARIVER SAN FRANCISCO	40	Y	Y	N
SEAWIND CROWN	136	Y	Y	N
SENATOR	98	N	N	N
SENSATION	119	Y	Y	Y
SEVEN OCEAN	22	Y	N	N
SEWARD JOHNSON	750	N	N	N
SGT WILLIAM A BUTTON	50	Y	Y	N
SGT. METEJ KOCAK	68	N	Y	Y
SHELLY BAY	171	Y	Y	Y
SHIRAOI MARU	204	Y	Y	Y
SIBOHELLE	25	Y	Y	N
SINCERE GEMINI	1	N	N	N
SINCERE SUCCESS	40	N	N	N
SKAUGRAN	5	N	N	N
SKOGAFOSS	94	N	N	N
SKY PRINCESS	150	N	N	N
SOKOLICA	107	Y	Y	Y
SOL DO BRASIL	18	N	N	N
SOLAR WING	101	N	N	N
SONG OF AMERICA	22	N	N	N
SONORA	172	Y	N	N
SOREN TOUBRO	70	N	N	N
SOUTHERN LION	79	N	N	N
SPRING GANNET	42	N	N	N
SPRING WAVE	100	Y	Y	Y
ST. CLAIR	11	N	N	N
STAR ALABAMA	21	N	N	N
STAR AMERICA	149	Y	N	N
STAR EAGLE	51	N	N	N
STAR EVVIVA	53	N	N	N
STAR GRAN	120	N	N	Y
STAR HANSA	3	N	N	N
STAR HARDANGER	164	N	Y	Y
STAR HERDLA	123	Y	Y	Y
STAR HOYANGER	1	N	N	N
STAR SKARVEN	107	Y	Y	Y
STAR SKOGANGER	27	N	N	N
STAR STRONEN	93	N	N	N
STATENDAM	6	N	N	N
STELLA LYKES	199	N	Y	Y
STEPHAN J	405	Y	Y	Y
STEWART J. CORT	189	Y	Y	N
STOLT CONDOR	10	N	N	N
STONEWALL JACKSON	130	Y	Y	N
STRONG ICELANDER	7	N	N	N
STRONG VIRGINIAN	105	N	N	N
SUMMER BREEZE	71	N	N	N
SUN DANCE	37	Y	N	N

Continued on Page 84

Continued from Page 83

NAME	TOTAL OBS	MANUSCRIPT RECEIVED		
		JUL	AUG	SEP
SUN PRINCESS	13	N	N	N
SUNBELT DIXIE	91	N	N	Y
SUSAN W. HANNAH	111	N	N	N
SVEN OLTMANN	70	N	N	N
T/V STATE OF MAINE	3	N	N	N
TAI CHUNG	48	Y	N	N
TAI HE	142	N	N	N
TAI SHING	71	Y	N	N
TAIKO	5	N	N	N
TAKAYAMA	309	Y	N	Y
TALLAHASSEE BAY	30	N	N	N
TANABATA	46	N	N	N
TARONGA	38	N	N	N
TELLUS	105	N	N	N
TEQUI	15	N	N	N
TEXAS	101	N	N	Y
TEXAS CLIPPER	35	N	N	N
TILLIE LYKES	184	N	N	Y
TOLUCA	233	N	N	N
TONSINA	9	N	N	N
TORBEN	174	N	N	Y
TORM FREYA	86	Y	Y	N
TOWER BRIDGE	41	N	N	N
TRANSWORLD BRIDGE	144	Y	Y	Y
TRITON	14	N	N	N
TROPIC DAY	16	Y	N	N
TROPIC FLYER	53	Y	Y	Y
TROPIC ISLE	35	Y	Y	Y
TROPIC JADE	33	Y	Y	N
TROPIC LURE	46	Y	Y	Y
TROPIC SUN	132	Y	Y	Y
TROPIC TIDE	114	Y	Y	Y
TROPICALE	5	N	N	N
TRSL ARCTURUS	22	N	N	N
TRUST 38	138	Y	N	N
TULSIDAS	1	N	N	N
TURMOIL	5	N	N	N
TYSON LYKES	125	Y	N	Y
USCGC ACACIA (WLB406)	25	N	Y	N
USCGC ACTIVE WMEC 618	140	N	N	N
USCGC ACUSHNET WMEC 16	83	N	N	N
USCGC BOUTWELL WHEC 71	5	N	N	N
USCGC BRAMBLE (WLB 392	4	N	N	N
USCGC CHASE (WHEC 718)	1	N	N	N
USCGC COURAGEOUS	3	N	N	N
USCGC DAUNTLESS WMEC 6	141	N	N	N
USCGC DILIGENCE WMEC 6	11	N	N	N
USCGC DURABLE (WMEC 62	18	N	N	N
USCGC EAGLE (WIX 327)	1	N	N	N
USCGC FIREBUSH WLB 393	13	N	N	N
USCGC HAMILTON WHEC 71	7	N	N	N
USCGC HARRIET LANE	53	N	N	N
USCGC IRONWOOD (WLB 29	21	N	N	N
USCGC JARVIS (WHEC 725	5	N	N	N
USCGC LEGARE	173	N	N	Y
USCGC MELLON (WHEC 717	85	N	N	N
USCGC MIDGETT (WHEC 72	86	N	Y	N
USCGC MORGENTHAU	14	N	N	N
USCGC PLANETREE	38	N	N	N
USCGC POLAR SEA__(WAGB	6	N	N	N
USCGC POLAR STAR (WAGB	1	N	N	N
USCGC RELIANCE WMEC 61	8	N	N	N
USCGC SASSAFRAS	2	N	N	N

NAME	TOTAL OBS	MANUSCRIPT RECEIVED		
		JUL	AUG	SEP
USCGC SEDGE (WLB 402)	11	N	N	N
USCGC SENECA	56	N	N	N
USCGC SPENCER	4	N	N	N
USCGC STEADFAST (WMEC	84	Y	N	N
USCGC STORIS (WMEC 38)	76	N	N	N
USCGC SUNDEW (WLB 404)	6	N	N	N
USCGC SWEETBRIER WLB 4	26	Y	N	Y
USCGC TAHOMA	133	N	Y	N
USCGC TAMPA WMEC 902	97	N	Y	N
USCGC THETIS	91	N	Y	Y
USCGC VALIANT (WMEC 62	37	N	Y	Y
USCGC VENTUROUS WMEC 6	90	Y	N	N
USCGC WOODRUSH (WLB 40	8	N	N	N
USNS ALGOL	10	N	N	N
USNS ALTAIR	3	N	N	N
USNS ANTARES	4	N	N	N
USNS APACHE (T-ATF 172	93	Y	Y	Y
USNS BOWDITCH	126	Y	Y	Y
USNS CAPELLA	23	N	N	N
USNS DENEBOLA	8	N	N	N
USNS GUS W. DARNELL	62	N	N	N
USNS HAYES	191	Y	N	Y
USNS JOHN MCDONNELL (T	20	N	N	N
USNS PATHFINDER T-AGS	214	Y	Y	Y
USNS PATUXENT	176	Y	Y	Y
USNS PECOS	11	Y	N	N
USNS SATURN T-AFS-10	103	Y	Y	N
USNS SIRIUS (T-AFS 8)	96	Y	Y	N
USNS SUMNER	107	Y	Y	Y
USNS TIPPECANOE (TAO-1	335	N	Y	Y
USNS VANGUARD TAG 194	313	Y	Y	N
VERA ACORDE	11	N	N	N
VICTORIA	40	N	N	N
VIRGINIA	326	Y	Y	Y
VISAYAN GLORY	135	Y	N	N
VIVA	179	Y	Y	N
WALTER J. MCCARTHY	74	Y	Y	Y
WAVELET	32	N	N	N
WECOMA	155	Y	Y	N
WESTERN LION	95	N	N	N
WESTWARD VENTURE	266	Y	Y	N
WESTWOOD ANETTE	127	Y	Y	Y
WESTWOOD BELINDA	155	N	N	N
WESTWOOD CLEO	76	N	N	Y
WESTWOOD FUJI	170	Y	Y	Y
WESTWOOD HALLA	173	N	N	N
WESTWOOD JAGO	77	N	N	N
WESTWOOD MARIANNE	68	N	N	N
WILFRED SYKES	112	Y	Y	N
WILLIAM E. MUSSMAN	111	Y	Y	N
WOLVERINE	48	Y	Y	N
YUCATAN	98	N	N	N
YURIY OSTROVSKIY	243	Y	N	Y
ZENITH	16	N	N	N
ZIM AMERICA	95	N	N	N
ZIM ASIA	100	N	N	N
ZIM ISRAEL	90	N	N	N
ZIM ITALIA	73	N	N	Y
ZIM KOREA	87	N	N	N
ZIM MONTEVIDEO	55	N	N	N
GRAND TOTAL	99,112			

Buoy Climatological Data Summary –

2nd and 3rd Quarters 1997

Weather observations are taken each hour during a 20-minute averaging period, with a sample taken every 0.67 seconds. The significant wave height is defined as the average height of the highest one-third of the waves during the average period each hour. The maximum significant wave height is the highest of those values for that month. At most stations, air temperature, water temperature, wind speed and direction are sampled once per second during an 8.0-minute averaging period each hour (moored buoys) and a 2.0-minute averaging period for fixed stations (C-MAN). Contact NDBC Data Systems Division, Bldg. 1100, SSC, Mississippi 39529 or phone (601) 688-1720 for more details.

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
APRIL 1997													
41001	34.7N	072.6W	0710	16.1	18.5	2.7	8.6	01/12	15.3	NW	38.1	01/16	1013.6
41002	32.3N	075.2W	0709	19.3	22.7	2.4	7.2	01/06	15.3	W	33.6	01/05	1014.5
41004	32.5N	079.1W	0708	18.4		1.4	3.8	12/15	14.1	SW	30.5	23/14	1014.2
41009	28.5N	080.2W	1426	21.8	23.1	1.3	3.0	12/11	14.3	SE	31.7	18/09	1015.3
41010	28.9N	078.5W	1391	22.2	24.7	1.9	4.6	02/23	14.8	E	30.1	18/06	1014.4
42001	25.9N	089.7W	0711	22.9	23.9	1.5	3.6	28/23	15.2	NE	30.5	01/21	1014.3
42002	25.9N	093.6W	0709	22.8	23.5	1.7	3.6	08/19	15.2	NE	36.7	01/12	1012.2
42007	30.1N	088.8W	0710	18.4	19.4	0.8	2.5	05/17	13.0	NE	36.5	26/13	1014.5
42019	27.9N	095.0W	0704	20.5		1.6	4.2	05/03	14.1	E	29.9	05/02	1012.7
42035	29.3N	094.4W	0708	19.0	20.0	1.1	3.5	05/05					1012.8
42036	28.5N	084.5W	0710	20.4	21.0	1.2	3.3	29/04	12.5	NE	29.9	26/09	1014.9
42039	28.8N	086.0W	0715		21.4	1.3	3.4	11/23	12.9	NE	25.6	18/05	1015.6
42040	29.2N	088.3W	0711	19.8	21.2	1.3	3.5	26/15	13.8	NE	31.9	26/14	1015.4
44004	38.5N	070.7W	0710	9.8	12.4	2.7	7.6	01/18	14.2	NW	35.9	19/17	1011.9
44007	43.5N	070.2W	0713	4.8	4.6	1.0	4.4	01/03	11.4	S	35.9	01/12	1009.7
44008	40.5N	069.4W	0204	5.4	5.3	2.4	6.8	01/23					1011.4
44009	38.5N	074.7W	0709	10.4	8.6	1.3	4.2	01/12	13.4	NW	36.9	01/11	1012.6
44011	41.1N	066.6W	0687	4.8	4.8	2.3	7.4	02/12	14.5	NW	39.4	25/01	1008.1
44013	42.4N	070.7W	0703	6.1	5.1	1.3	7.6	19/14	12.0	NW	38.3	01/01	1010.2
44014	36.6N	074.8W	0712	10.1	9.6	1.7	5.4	01/16	11.9	N	40.4	01/09	1013.6
44025	40.3N	073.2W	0713	7.4	6.9	1.2	4.6	01/06	12.6	NW	37.3	01/05	1011.8
44028	41.4N	071.1W	0485	5.8	5.7	0.8	2.9	13/22	14.4	NW	38.1	01/04	1011.1
45001	48.1N	087.8W	0289	2.0	1.0	0.4	1.7	29/18	7.5	N	22.2	30/05	1013.1
45002	45.3N	086.4W	0711	1.8	1.5	0.8	3.9	07/02	11.1	S	31.7	07/01	1014.5
45003	45.3N	082.8W	0466	2.3	1.5	0.5	1.6	15/21	9.2	NW	20.6	17/01	1013.4
45004	47.6N	086.6W	0278	2.2	1.1	0.4	1.5	30/11	8.5	N	19.8	29/13	1013.4
45005	41.7N	082.4W	0374	6.3	4.7	0.4	0.9	28/06	7.4	S	17.5	18/08	1011.8
45006	47.3N	089.9W	0308	2.0	0.8	0.5	1.4	29/14	7.7	NE	21.8	29/12	1013.5
45007	42.7N	087.0W	0710	3.1	2.6	0.9	4.5	06/23	10.5	N	35.9	06/21	1014.8
45008	44.3N	082.4W	0192	3.1	1.3	0.3	0.6	29/20	6.7	N	13.0	30/21	1012.9
46001	56.3N	148.2W	0714	4.0	4.7	2.5	7.2	02/16	13.7	E	30.5	02/06	
46002	42.5N	130.3W	0677	10.7	11.2	2.2	4.5	23/22	12.3	W	32.8	20/01	1019.2
46003	51.9N	155.9W	0710	3.2	4.1	2.8	8.0	24/05	12.3	W	32.6	01/02	1002.1
46005	46.1N	131.0W	0591	9.2	9.3	2.4	6.0	23/20	12.6	SW	27.6	23/15	1015.1
46006	40.9N	137.5W	0709	12.2	12.3	2.5	5.0	22/18					1019.3
46011	34.9N	120.9W	0713	11.6	11.5	2.2	5.1	02/02	14.3	NW	29.5	24/02	1015.6
46012	37.4N	122.7W	0714	11.1		2.1	4.2	25/06	12.6	NW	28.4	09/15	1017.0
46013	38.2N	123.3W	0453	10.4		2.1	4.4	11/03	15.4	NW	32.4	04/06	1018.3
46014	39.2N	124.0W	0715	11.0	11.0	2.1	4.8	03/23	13.2	NW	32.6	04/01	1018.4

Continued on Page 86

Continued from Page 85

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
46022	40.7N	124.5W	0708	10.6	10.5	2.2	4.4	02/03	12.0	N	31.3	02/03	1019.6
46025	33.8N	119.1W	0711	14.8	15.5	1.3	3.4	24/01	9.0	W	31.3	24/04	1013.3
46026	37.8N	122.8W	0713	10.4	10.0	1.9	3.7	28/00	13.3	NW	28.4	11/03	1017.1
46027	41.9N	124.4W	0713	10.1	10.4	1.9	3.7	05/00	11.9	NW	35.2	04/00	1019.2
46028	35.7N	121.9W	0712	11.5	11.3	2.5	5.5	02/03	17.5	NW	29.5	02/17	1016.5
46029	46.2N	124.2W	0714	10.1	10.1	2.0	5.2	30/19	11.8	S	30.7	20/03	1018.5
46030	40.4N	124.5W	0708	10.2	9.8	2.2	4.5	02/04	11.7	N	27.0	02/02	1020.1
46035	56.9N	177.8W	0698	1.3	2.8	1.9	5.8	02/03	15.3	E	33.2	02/02	1008.8
46041	47.4N	124.5W	0711		9.9	1.9	4.7	04/00	9.7	SE	28.8	30/18	1017.6
46042	36.8N	122.4W	0714		11.9	2.1	4.3	02/05	12.5	NW	25.3	02/12	1017.8
46045	33.8N	118.5W	0708	14.7	15.4	1.1	3.2	24/02					1013.1
46054	34.3N	120.5W	0693	11.7	12.1	2.2	4.5	02/02	20.5	NW	33.2	09/09	1014.9
46059	38.0N	130.0W	0712	13.6	13.8	2.1	3.5	23/16	11.0	N	24.3	03/14	1022.7
46060	60.6N	146.8W	1424	4.5	4.8	0.6	2.6	05/18	8.5	E	30.7	05/17	1010.3
46061	60.2N	146.8W	1374	4.2	4.6	1.5	6.2	01/22	12.3	E	38.5	01/23	1009.9
51001	23.4N	162.3W	0715	22.9	24.3	2.6	6.8	02/11	12.4	NE	22.8	10/04	1019.1
51002	17.2N	157.8W	0710	25.1	25.6	2.2	4.1	03/06	15.4	E	23.3	29/18	1015.3
51003	19.1N	160.8W	0715	24.8	25.7	2.2	4.5	02/20	11.4	NW	21.9	25/22	1015.1
51004	17.4N	152.5W	0708	24.3		2.2	3.7	12/20	14.1	E	20.3	13/03	1016.3
91204	9.9N	139.7E	0490	30.5					10.5	NE	25.2	29/02	1009.8
91222	18.1N	145.8E	0119	26.6									1012.2
91251	11.4N	162.4E	0699	27.9					16.8	E	27.6	12/22	1009.2
91328	8.6N	149.7E	0706	27.8					7.9	NE	30.6	15/04	1010.2
91343	7.6N	155.2E	0711	27.8									1008.1
91352	6.2N	160.7E	0712	27.5					6.3	NE	28.0	11/07	1009.6
91355	5.4N	163.0E	0713	27.1					7.2	E	24.0	07/10	1008.3
91374	8.7N	171.2E	0715	27.4					6.0	NE	14.0	01/19	1010.0
91377	6.1N	172.1E	0448	28.0					5.8	E	21.3	01/06	1011.8
91411	8.3N	137.5E	0320	27.9									1009.6
91442	4.6N	168.7E	0708	27.9					8.8	N	29.8	17/22	1009.3
ABAN6	44.3N	075.9W	0709	4.7	2.4				3.5	N	19.2	07/04	1014.1
ALSN6	40.5N	073.8W	0711	8.8		0.8	2.6	28/15	17.3	NW	41.0	01/01	1012.1
BLIA2	60.8N	146.9W	1424	4.0					8.8	N	25.6	01/15	1011.0
BURL1	28.9N	089.4W	0705	18.8					14.7	NE	42.6	26/13	1013.6
BUZM3	41.4N	071.0W	0080	9.0	7.7	1.3	2.6	29/11	15.9	S	34.5	28/15	1011.4
CARO3	43.3N	124.4W	0708	10.1					11.4	S	38.2	20/03	1019.6
CDRF1	29.1N	083.0W	0713	19.9					10.0	NE	31.7	28/13	1015.7
CHLV2	36.9N	075.7W	0711	11.3	10.6	1.1	3.6	01/17	16.3	S	45.4	01/02	1014.5
CLKN7	34.6N	076.5W	0711	15.6					12.9	SW	33.3	01/05	1015.6
CSBF1	29.7N	085.4W	0708	19.1					8.6	W	26.6	23/09	1016.0
DBLN6	42.5N	079.4W	0711	5.2					11.6	SW	38.4	07/18	1014.7
DPIA1	30.3N	088.1W	0714	18.3	19.5				12.9	N	37.6	26/12	1015.5
DRYF1	24.6N	082.9W	0709	24.4					12.3	E	26.0	12/02	1014.8
DSLN7	35.2N	075.3W	0714	14.3		1.7	5.4	01/19	19.9	N	50.8	13/00	1013.9
DUCN7	36.2N	075.8W	0712	12.7		0.9	2.8	01/21	13.4	N	34.4	01/06	1015.3
FBIS1	32.7N	079.9W	0713	17.5					9.7	SW	23.3	18/08	1015.4
FFIA2	57.3N	133.6W	0710	5.7					10.5	N	41.9	01/22	1013.4
FPSN7	33.5N	077.6W	0707	17.5		1.5	4.2	28/06	17.7	SW	41.6	01/00	1013.9
FWYF1	25.6N	080.1W	0513	23.8	25.3				15.5	E	30.6	23/22	1015.1
GDIL1	29.3N	090.0W	0710	19.2	20.2				12.2	NE	37.9	26/12	1014.9
GLLN6	43.9N	076.5W	0713	4.7					11.8	W	34.1	08/19	1014.1
IOSN3	43.0N	070.6W	0709	5.5					14.8	NW	47.5	01/03	1010.1
KTNF1	29.8N	083.6W	0710	18.7					10.0	NE	33.8	23/12	1015.4
LKWF1	26.6N	080.0W	0708	23.0	24.8				12.4	E	30.0	12/08	1015.3
MDRM1	44.0N	068.1W	0709	3.8					17.3	NW	48.4	19/06	1009.4
MISM1	43.8N	068.9W	0711	3.7					15.2	NW	45.7	19/02	1009.9
MLRF1	25.0N	080.4W	0706	24.1	25.5				13.5	SE	30.2	18/03	1015.6
NWPO3	44.6N	124.1W	0712	9.7					10.6	S	38.3	20/08	1019.6
PILM4	48.2N	088.4W	0712	0.6					11.5	N	40.2	07/09	1015.9
POTA2	61.1N	146.7W	1425	3.9					11.7	N	29.4	10/19	1010.8
PTAC1	39.0N	123.7W	0706	11.7					10.2	N	26.5	18/20	1018.7
PTAT2	27.8N	097.1W	0275	19.7	20.5				14.9	SE	33.1	03/09	1011.0
PTGC1	34.6N	120.7W	0711	11.7					17.9	N	40.0	24/08	1016.2
ROAM4	47.9N	089.3W	0383	2.0					12.9	NE	30.6	06/23	1012.6
SANF1	24.5N	081.9W	0707	24.5	25.3				12.5	E	29.2	12/03	1014.7
SAUF1	29.9N	081.3W	0705	19.7	19.9				10.6	W	26.9	26/23	1015.9
SBIO1	41.6N	082.8W	0710	7.0					11.1	NW	40.5	07/04	1016.0
SGNW3	43.8N	087.7W	0710	3.7					10.2	S	33.7	06/19	1016.4
SISW1	48.3N	122.9W	0710	9.0					10.2	W	37.8	03/14	1017.7
SMKF1	24.6N	081.1W	0710	24.6	25.9				14.0	E	32.9	12/04	1015.5
SPGF1	26.7N	079.0W	0709	23.3	25.5				10.3	E	30.0	24/00	1016.3
SRST2	29.7N	094.1W	0705	18.1					12.3	E	35.2	25/19	1014.1
STDM4	47.2N	087.2W	0708	1.5					14.1	NW	47.1	07/05	1014.6
SUPN6	44.5N	075.8W	0706	4.6	2.6				8.9	SW	31.4	08/17	1014.8
THIN6	44.3N	076.0W	0703	4.6									
TPLM2	38.9N	076.4W	0707	11.0	10.5				12.4	NW	34.2	19/04	1014.5
TTIW1	48.4N	124.7W	0707	8.7					13.4	E	36.6	16/15	1017.7
VENF1	27.1N	082.5W	0710	21.4	23.8				10.5	E	30.1	18/05	1016.2
WPOW1	47.7N	122.4W	0703	9.4					8.9	S	32.2	30/21	1018.5

MAY 1997

41001	34.7N	072.6W	0742	19.3	19.9	2.0	4.7	28/01	13.4	S	28.6	10/03	1016.4

Continued on Page 87

Continued from Page 86

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
41002	32.3N	075.2W	0737	21.7	22.8	1.6	4.3	28/04	11.7	SW	25.5	13/10	1016.7
41004	32.5N	079.1W	0734	21.4		1.1	3.4	28/09	12.3	SW	27.4	28/08	1016.1
41008	31.4N	080.9W	0452	22.9	23.2	0.9	3.0	28/12	11.9	S	28.4	28/11	1016.3
41009	28.5N	080.2W	1480	24.3	25.0	0.8	3.1	29/02	10.6	SE	33.0	03/21	1016.9
41010	28.9N	078.5W	1472	24.2	25.6	1.1	3.7	28/20	9.9	SE	23.3	28/13	1015.7
42001	25.9N	089.7W	0740	24.9	25.1	0.8	2.3	04/17	10.3	E	23.9	04/13	1016.2
42002	25.9N	093.6W	0741	25.1	25.6	1.0	2.7	04/21	11.7	SE	25.6	29/08	1014.2
42003	25.9N	085.9W	0214	27.1	28.4	0.6	1.5	29/23	10.1	E	17.3	25/16	1015.1
42007	30.1N	088.8W	0742	23.0	23.9	0.5	1.2	29/04	9.8	S	22.7	04/05	1016.0
42035	29.3N	094.4W	0734	23.6	24.5	0.7	1.8	10/13					1014.5
42036	28.5N	084.5W	0734	23.7	24.2	0.5	2.1	04/14	7.7	NE	21.4	04/12	1017.5
42039	28.8N	086.0W	0740	23.4	23.6	0.5	2.0	04/12	7.4	E	33.2	03/15	1017.5
42040	29.2N	088.3W	0735	23.1	23.8	0.6	2.4	10/18	8.2	SE	24.7	25/10	1017.3
44004	38.5N	070.7W	0738	13.2	12.8	1.7	3.8	16/16	13.6	S	29.7	04/01	1014.8
44007	43.5N	070.2W	0740	8.8	6.9	0.9	2.7	04/03	10.0	S	23.9	04/01	1009.4
44009	38.5N	074.7W	0733	14.1	12.2	1.1	2.7	03/20	13.5	S	27.6	03/17	1013.9
44011	41.1N	066.6W	0728	8.1	6.2	1.8	3.7	04/18	10.6	SW	25.3	16/18	1011.9
44013	42.4N	070.7W	0708	10.5	7.3	0.6	1.5	03/22	10.6	W	26.6	02/14	1010.9
44014	36.6N	074.8W	0737	15.1	14.1	1.3	3.0	28/01	12.1	S	29.5	16/09	1015.4
44025	40.3N	073.2W	0726	11.8	10.9	1.2	3.8	04/00	12.7	S	33.4	03/18	1012.8
45001	48.1N	087.8W	0733	3.1	1.8	0.6	2.7	09/15	9.2	SW	29.3	09/14	1014.0
45002	45.3N	086.4W	0733	4.0	2.4	0.6	2.2	05/13	9.9	S	28.8	01/08	1012.9
45003	45.3N	082.8W	0726	3.8	2.1	0.7	2.3	05/20	10.7	W	25.8	01/16	1012.5
45004	47.6N	086.6W	0740	2.9	1.7	0.6	3.0	09/15	9.9	NW	27.6	09/12	1014.4
45005	41.7N	082.4W	0297	8.9	7.6	0.6	2.9	01/13	11.3	W	35.6	01/12	1013.2
45006	47.3N	089.9W	0741	3.4	1.7	0.5	2.9	12/11	9.0	NE	28.8	12/11	1014.7
45007	42.7N	087.0W	0736	5.3	3.2	0.6	4.3	01/09	9.2	N	33.0	01/07	1012.9
45008	44.3N	082.4W	0730	4.1	2.3	0.7	3.3	01/19	10.0	NW	28.8	01/16	1013.3
46001	56.3N	148.2W	0742	6.7	7.2	1.8	3.7	03/12	11.6	W	28.6	11/08	
46002	42.5N	130.3W	0682	13.0	13.0	2.2	4.3	03/20	10.8	SE	26.6	02/08	1015.6
46003	51.9N	155.9W	0741	5.7	5.9	2.0	4.1	20/03	10.3	E	21.2	25/17	1014.9
46005	46.1N	131.0W	0733	11.2	11.4	2.0	4.7	02/13	11.9	SE	32.1	02/10	1015.7
46006	40.9N	137.5W	0249	13.5	13.9	2.3	5.0	03/11	13.2	W	23.7	30/13	1010.8
46011	34.9N	120.9W	0739	13.1	12.8	1.7	3.3	01/12	12.8	NW	25.3	01/07	1013.7
46012	37.4N	122.7W	0739	13.3		1.4	2.8	01/12	7.2	NW	25.3	01/06	1015.4
46014	39.2N	124.0W	0741	13.7	13.7	1.6	3.1	04/17	8.4	NW	25.3	01/03	1016.2
46022	40.7N	124.5W	0732	13.1	13.4	1.5	3.0	15/02	9.2	N	26.4	03/01	1017.0
46025	33.8N	119.1W	0735	17.0	18.1	1.1	2.3	25/03	5.7	W	22.3	25/06	1012.1
46026	37.8N	122.8W	0736	12.7	12.6	1.3	2.5	01/11	9.0	NW	24.7	01/03	1015.6
46027	41.9N	124.4W	0200	11.2	12.0	1.9	2.8	04/17	8.8	NW	22.2	07/02	1019.7
46028	35.7N	121.9W	0742	13.0	12.0	1.7	3.5	05/03	15.6	NW	26.2	06/07	1014.7
46029	46.2N	124.2W	0742	13.4	13.1	1.5	3.9	01/05	11.0	S	29.0	03/01	1016.9
46030	40.4N	124.5W	0733	12.7	12.4	1.5	3.2	04/15	10.8	N	22.0	03/02	1017.4
46035	56.9N	177.8W	0724	3.3	3.6	2.5	5.9	11/07	18.4	SW	38.7	15/21	1004.3
46041	47.4N	124.5W	0741		13.0	1.4	3.7	01/01	8.5	NW	25.8	02/23	1016.4
46042	36.8N	122.4W	0739		13.2	1.5	3.0	01/15	7.6	NW	18.3	01/12	1016.1
46045	33.8N	118.5W	0736	17.8	19.2	0.9	1.7	25/03					1012.0
46054	34.3N	120.5W	0719	13.6	13.6	1.7	3.3	01/17	18.9	NW	31.1	28/01	1012.9
46059	38.0N	130.0W	0739	16.7	16.7	1.8	4.0	14/10	9.1	S	22.9	28/01	1017.5
46060	60.6N	146.8W	1482	8.1	8.3	0.4	2.2	10/22	8.1	E	33.0	10/21	1016.4
46061	60.2N	146.8W	1472		7.2	1.0	4.1	10/21	8.7	N	36.5	10/20	1016.4
51001	23.4N	162.3W	0740	22.2	23.7	2.2	3.4	02/13	13.4	NE	22.2	03/20	1017.8
51002	17.2N	157.8W	0741	25.5	26.3	1.8	2.8	02/15	11.7	NE	22.7	03/18	1013.6
51003	19.1N	160.8W	0742	24.8	26.0	2.0	3.4	12/10	11.2	NE	20.7	16/08	1013.4
51004	17.4N	152.5W	0733	24.9		1.9	2.9	12/20	10.2	NE	18.9	16/19	1014.0
91222	18.1N	145.8E	0139	26.9									1011.3
91251	11.4N	162.4E	0732	28.1					14.1	NE	29.1	27/02	1008.0
91328	8.6N	149.7E	0639	28.3					6.6	NE	17.5	28/19	1009.5
91343	7.6N	155.2E	0741	28.0									1007.9
91352	6.2N	160.7E	0742	27.7					6.2	NE	32.9	24/07	1009.3
91355	5.4N	163.0E	0634	27.6					9.0	NE	17.1	02/22	1007.3
91374	8.7N	171.2E	0741	27.2					5.5	NE	13.4	08/06	1009.3
91377	6.1N	172.1E	0475	27.5									1011.3
91411	8.3N	137.5E	0295	28.6									1009.4
91442	4.6N	168.7E	0732	28.1					8.6	NE	33.3	24/20	1008.9
ABAN6	44.3N	075.9W	0737	10.0	7.2				3.8	S	19.1	01/16	1011.8
ALSN6	40.5N	073.8W	0736	12.8		0.8	2.3	04/01	17.8	W	42.6	02/07	1012.9
BLIA2	60.8N	146.9W	1479	7.9					6.8	N	26.9	11/16	1017.0
BURL1	28.9N	089.4W	0735	22.9					9.6	SE	25.2	30/16	1016.3
BUZM3	41.4N	071.0W	0737	10.7	9.5	1.1	3.7	03/22	15.1	SW	36.3	03/22	1012.8
CARO3	43.3N	124.4W	0731	13.2					8.7	N	29.0	30/20	1017.2
CDRF1	29.1N	083.0W	0739	23.7					8.0	W	20.3	28/22	1017.2
CHLV2	36.9N	075.7W	0732	15.9	14.9	0.8	2.3	28/04	15.9	S	31.4	16/11	1015.9
CLKN7	34.6N	076.5W	0737	19.5					12.9	SW	33.8	27/22	1017.4
CSBF1	29.7N	085.4W	0734	22.7					7.1	SW	26.8	31/21	1017.5
DBLN6	42.5N	079.4W	0734	9.9					13.5	SW	41.2	01/18	1013.0
DPIA1	30.3N	088.1W	0739	22.8	24.4				9.8	S	28.4	04/07	1016.9
DRYF1	24.6N	082.9W	0732	26.5	28.2				8.9	NE	26.3	24/17	1016.1
DSLN7	35.2N	075.3W	0735	19.2		1.2	3.4	27/19	20.1	SW	41.4	16/07	1015.8
DUCN7	36.2N	075.8W	0730	17.4		0.6	2.4	28/05	13.6	SW	28.3	03/17	1017.0
FBIS1	32.7N	079.9W	0714	21.2					10.2	SW	29.7	28/04	1017.8
FFIA2	57.3N	133.6W	0739	9.1					8.3	N	25.4	19/14	1017.1
FPSN7	33.5N	077.6W	0730	20.5		1.2	3.4	28/03	16.8	SW	36.9	26/07	1015.8
FWYF1	25.6N	080.1W	0730	26.1	27.1				11.7	E	28.3	28/05	1016.6
GDIL1	29.3N	090.0W	0731	23.7	25.7				9.1	SE	22.7	04/07	1016.5

Continued on Page 88

Buoy Climatological Data Summary

Continued from Page 87

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
GLLN6	43.9N	076.5W	0732	7.8					13.2	W	33.6	02/05	1012.2
IOSN3	43.0N	070.6W	0733	10.0					15.2	S	36.5	02/15	1010.0
KTNF1	29.8N	083.6W	0738	22.4					8.4	SW	23.0	03/19	1016.9
LKWF1	26.6N	080.0W	0731	25.4	26.7				10.2	E	22.4	05/09	1016.5
LONF1	24.9N	080.9W	0290	27.5	29.7				7.9	E	19.0	29/22	1015.7
MDRM1	44.0N	068.1W	0733	7.3					15.6	SW	36.8	17/05	1009.7
MISM1	43.8N	068.9W	0729	7.6					16.0	SW	39.2	04/01	1009.6
MLRF1	25.0N	080.4W	0729	26.3	27.3				9.6	E	25.7	05/14	1016.6
NWPO3	44.6N	124.1W	0732	12.7					8.5	S	24.3	03/02	1017.5
PILM4	48.2N	088.4W	0726	4.1					9.7	N	30.8	09/12	1015.6
POTA2	61.1N	146.7W	1470	8.3					7.3	SW	20.9	25/19	1016.7
PTAC1	39.0N	123.7W	0734	13.1					8.3	N	21.2	01/07	1016.2
PTAT2	27.8N	097.1W	0732	23.6	25.2				12.2	SE	27.8	03/10	1014.1
PTGC1	34.6N	120.7W	0730	13.5					17.2	N	31.0	10/09	1014.6
ROAM4	47.9N	089.3W	0698	5.6					12.2	NE	37.9	12/05	1014.6
SANF1	24.5N	081.9W	0727	26.6	27.7				9.6	E	30.1	29/02	1015.7
SAUF1	29.9N	081.3W	0730	22.9	23.5				9.6	NE	32.8	27/23	1017.5
SBIO1	41.6N	082.8W	0731	11.4					13.7	W	44.1	01/12	1014.0
SGNW3	43.8N	087.7W	0350	7.9	10.1				11.1	N	35.1	01/05	1013.1
SISW1	48.3N	122.9W	0741	11.5					8.6	W	35.8	17/04	1016.6
SMKF1	24.6N	081.1W	0735	26.9	27.8				10.0	E	26.8	13/08	1016.5
SPGF1	26.7N	079.0W	0736	25.5	27.4				7.6	E	22.6	28/21	1017.5
SRST2	29.7N	094.1W	0734	23.3					10.7	S	27.1	31/08	1015.5
STDM4	47.2N	087.2W	0733	4.7					13.1	NW	37.2	09/14	1013.7
SUPN6	44.5N	075.8W	0732	9.8	7.9				10.4	SW	30.0	12/19	1012.7
THIN6	44.3N	076.0W	0731	9.7									
TPLM2	38.9N	076.4W	0735	15.7	15.3				12.9	S	30.1	06/20	1014.8
TTIW1	48.4N	124.7W	0738	11.9					11.7	E	33.3	06/02	1016.8
VENF1	27.1N	082.5W	0732	24.2	26.7				7.9	E	23.2	04/22	1017.5
WPOW1	47.7N	122.4W	0732	13.2					8.6	N	23.0	20/03	1017.1

JUNE 1997

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
41001	34.7N	072.6W	0715	22.5	22.9	1.4	4.0	05/13	10.5	S	23.3	01/16	1014.8
41002	32.3N	075.2W	0718	24.5	25.6	1.5	4.7	07/01	11.2	SW	28.2	01/10	1014.1
41004	32.5N	079.1W	0710	24.0		1.1	3.7	07/07	11.7	SW	28.4	07/03	1013.5
41008	31.4N	080.9W	0712	23.9	24.8	0.9	2.7	05/23	11.3	S	28.4	06/00	1014.3
41009	28.5N	080.2W	1433	26.0	26.7	0.8	2.2	10/04	10.6	SE	25.5	10/05	1014.3
41010	28.9N	078.5W	1434	26.4	27.5	1.2	3.3	06/00	10.4	S	24.5	05/23	1013.0
42001	25.9N	089.7W	0716	27.3	28.0	0.7	1.8	18/13	8.8	SE	22.0	18/09	1013.9
42002	25.9N	093.6W	0717	27.6	28.2	0.8	2.1	22/17	10.1	SE	22.5	20/11	1012.7
42003	25.9N	085.9W	0716	27.7	28.8	0.7	1.7	10/09	9.1	E	19.4	08/03	1013.5
42007	30.1N	088.8W	0716	26.0	27.0	0.5	1.8	10/02	9.6	S	23.5	10/14	1013.1
42035	29.3N	094.4W	0718	27.4	28.2	0.7	1.8	19/22					1012.1
42036	28.5N	084.5W	0714	26.1	26.7	0.7	2.4	09/12	8.5	S	24.1	09/09	1014.7
42039	28.8N	086.0W	0718	25.7	26.3	0.7	3.0	09/21	8.5	S	25.5	09/19	1014.6
42040	29.2N	088.3W	0718	26.2	27.2	0.7	2.7	10/01	8.7	S	27.0	23/14	1014.5
44004	38.5N	070.7W	0712	18.0	18.8	1.2	5.0	06/02	11.9	SW	30.7	04/22	1015.0
44007	43.5N	070.2W	0719	14.4	12.6	0.7	2.3	06/09	7.0	N	19.2	05/05	1013.2
44009	38.5N	074.7W	0714	18.7	17.4	1.1	3.9	03/14	8.1	S	21.2	26/23	1014.7
44011	41.1N	066.6W	0712	11.8	9.9	1.5	5.9	05/17	11.2	SW	34.4	05/10	1012.8
44013	42.4N	070.7W	0692	16.6		0.7	2.7	05/18	8.2	SW	20.0	05/11	1014.0
44014	36.6N	074.8W	0718	18.1	17.2	1.2	3.9	04/11	9.9	NE	27.2	04/18	1015.0
44025	40.3N	073.2W	0714	17.0	16.5	1.1	3.1	05/03	10.1	SW	28.2	02/22	1015.0
45001	48.1N	087.8W	0709	5.8	2.9	0.4	1.4	25/19	7.3	SW	18.5	25/18	1012.5
45002	45.3N	086.4W	0717	8.9	5.1	0.5	2.4	16/00	8.4	S	26.0	15/23	1013.0
45003	45.3N	082.8W	0709	7.7	3.3	0.3	1.5	16/07	7.7	SE	21.2	16/04	1013.9
45004	47.6N	086.6W	0719	5.8	2.7	0.4	1.7	16/00	7.2	S	29.3	23/23	1013.6
45005	41.7N	082.4W	0463	20.3	18.8	0.3	1.0	17/12	7.5	S	25.1	25/22	1012.0
45006	47.3N	089.9W	0717	6.4	2.8	0.3	1.2	15/16	7.4	NE	19.4	25/10	1012.7
45007	42.7N	087.0W	0712	12.7	9.6	0.4	1.4	21/11	7.2	N	20.8	17/01	1012.6
45008	44.3N	082.4W	0711	10.7	7.7	0.3	1.2	14/02	6.4	S	19.0	16/04	1014.5
46001	56.3N	148.2W	0713	9.8	10.6	1.5	3.5	14/20	10.3	SW	21.4	26/16	
46002	42.5N	130.3W	0701	14.1	15.1				12.9	NW	22.9	21/04	1018.1
46003	51.9N	155.9W	0716	8.4	8.8	1.6	4.5	14/01	8.4	W	24.1	14/02	1012.6
46005	46.1N	131.0W	0712	12.6	13.1	2.2	4.5	07/12	13.2	W	24.5	26/04	1015.9
46006	40.9N	137.5W	0626	13.9	14.9	2.2	5.9	03/07	13.8	NW	28.2	03/02	1021.2
46011	34.9N	120.9W	0712	13.7	13.6	2.2	4.1	06/05	12.0	NW	27.4	06/00	1012.1
46012	37.4N	122.7W	0718	13.0		2.2	4.2	08/03	11.8	NW	28.6	06/03	1012.5
46014	39.2N	124.0W	0714	13.2	12.5	2.3	4.6	08/04	17.0	NW	32.1	07/23	1013.4
46022	40.7N	124.5W	0712	13.3	12.6	2.1	4.9	08/08	10.1	N	29.7	08/10	1016.0
46023	34.7N	121.0W	0565	13.8	13.9	2.4	5.2	07/16	14.5	NW	32.6	06/02	1012.6
46025	33.8N	119.1W	0715	17.7	19.8	1.1	2.8	06/03	6.7	W	22.0	13/13	1011.0
46026	37.8N	122.8W	0716	12.0	11.3	2.1	4.0	08/00	13.9	NW	29.9	13/06	1012.1
46028	35.7N	121.9W	0719	13.7	13.1	2.5	4.5	13/13	17.6	NW	29.9	18/03	1012.4
46029	46.2N	124.2W	0719	14.8	15.3	1.7	3.9	19/01	9.9	NW	24.7	03/19	1016.2
46030	40.4N	124.5W	0711	12.4	11.2	2.0	4.5	08/03	11.7	N	24.3	07/06	1016.3
46035	56.9N	177.8W	0708	5.2	6.0	1.3	3.7	23/14	12.9	NE	22.2	22/11	1013.0
46041	47.4N	124.5W	0294		15.6	1.8	3.2	08/05	9.3	NW	24.9	03/21	1014.3
46042	36.8N	122.4W	0719		13.7	2.3	4.4	13/10	7.7	NW	8.9	01/17	1013.4
46045	33.8N	118.5W	0715	18.3	20.6	0.9	2.1	06/04					1010.9
46054	34.3N	120.5W	0697	14.1	14.8	2.1	4.0	06/06	18.3	NW	31.1	05/12	1011.7
46059	38.0N	130.0W	0712	16.5	17.7	2.1	4.1	04/02	14.1	NW	24.7	03/06	1020.9

Continued on Page 89

Continued from Page 88

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
46060	60.6N	146.8W	1432	12.0	13.0	0.3	1.0	05/08	7.7	SW	23.5	05/07	1011.0
46061	60.2N	146.8W	1387		12.2	0.8	2.4	14/01	7.1	SW	28.2	13/23	1011.2
51001	23.4N	162.3W	0715	25.1	25.4	2.1	3.5	20/13	13.5	E	22.3	30/23	1019.6
51002	17.2N	157.8W	0716	26.2	26.9	2.2	3.6	30/21	15.9	E	24.6	29/12	1014.9
51003	19.1N	160.8W	0717	26.1	26.9	1.9	3.1	20/20	12.6	NE	23.5	30/19	1014.8
51004	17.4N	152.5W	0709	25.4		2.2	3.6	30/02	14.6	NE	23.0	21/15	1015.3
91222	18.1N	145.8E	0134	27.8									1011.2
91251	11.4N	162.4E	0708	28.4					12.3	E	25.7	10/17	1009.9
91328	8.6N	149.7E	0446	27.8					5.0	NE	19.4	10/15	1010.0
91343	7.6N	155.2E	0713	27.5									1009.6
91352	6.2N	160.7E	0713	27.6					5.3	SW	23.2	18/19	1011.0
91374	8.7N	171.2E	0717	27.4					4.7	NE	13.3	25/20	1010.3
91377	6.1N	172.1E	0402	27.8									1012.7
91411	8.3N	137.5E	0230	28.1									1009.7
91442	4.6N	168.7E	0716	27.7					6.5	W	22.7	20/00	1010.2
ABAN6	44.3N	075.9W	0713	18.4	14.5				3.2	S	16.2	16/19	1014.4
ALSN6	40.5N	073.8W	0715	19.1		0.8	2.8	05/07	12.9	S	32.1	03/00	1015.0
BLIA2	60.8N	146.9W	1434	11.8					6.3	NW	29.3	05/09	1011.7
BURL1	28.9N	089.4W	0714	26.3					8.9	S	24.3	17/23	1013.5
BUZM3	41.4N	071.0W	0719	16.2	14.0	0.7	1.5	13/03	13.5	SW	30.9	26/20	1015.4
CARO3	43.3N	124.4W	0714	14.2					8.6	N	26.8	08/22	1017.0
CDRF1	29.1N	083.0W	0719	25.8					8.6	SW	19.9	01/06	1014.5
CHLV2	36.9N	075.7W	0712	20.0	19.2	0.8	2.5	05/05	13.6	NE	30.1	04/01	1015.7
CLKN7	34.6N	076.5W	0712	22.2					11.9	NE	35.6	03/22	1015.9
CSBF1	29.7N	085.4W	0719	25.5					7.8	SW	17.8	18/06	1014.6
DBLN6	42.5N	079.4W	0710	18.1					8.0	SW	27.6	25/19	1014.8
DISW3	47.1N	090.7W	0302	14.0					9.9	SW	23.9	18/07	1010.6
DPIA1	30.3N	088.1W	0719	25.7	27.4				9.0	SW	25.1	10/14	1014.0
DRYF1	24.6N	082.9W	0709	27.8	29.0				8.5	E	21.8	10/16	1014.1
DSLN7	35.2N	075.3W	0716	21.4		1.0	3.3	05/01	16.6	SW	34.9	04/19	1014.6
DUCN7	36.2N	075.8W	0654	20.4		0.7	2.6	04/14	12.2	NE	34.9	27/02	1016.1
FBIS1	32.7N	079.9W	0716	23.3					9.5	SW	27.7	28/23	1015.2
FFIA2	57.3N	133.6W	0715	11.6					7.4	N	25.6	03/16	1011.9
FPSN7	33.5N	077.6W	0711	23.2		1.1	3.6	07/04	14.8	SW	45.1	06/21	1013.7
FWYF1	25.6N	080.1W	0709	27.5	28.5				11.1	E	36.6	09/23	1014.7
GDIL1	29.3N	090.0W	0711	26.7	28.6				7.8	S	31.9	17/21	1013.8
GLLN6	43.9N	076.5W	0715	16.7					9.0	SW	27.7	22/20	1014.3
IOSN3	43.0N	070.6W	0711	16.6					11.3	W	28.3	23/03	1013.6
KTNF1	29.8N	083.6W	0713	24.8					8.9	SW	31.3	20/13	1014.1
LKWF1	26.6N	080.0W	0718	26.8	27.9				8.3	SE	27.9	01/22	1014.3
LONF1	24.9N	080.9W	0711	28.1	29.7				9.5	E	25.2	20/07	1014.4
MDRM1	44.0N	068.1W	0719	11.7					12.0	SW	26.4	26/02	1013.5
MISM1	43.8N	068.9W	0715	12.5					12.0	SW	27.6	26/02	1013.3
MLRF1	25.0N	080.4W	0711	27.7	28.4				9.9	SE	30.7	10/20	1014.7
NWPO3	44.6N	124.1W	0716	13.8					8.0	NW	28.5	09/01	1017.1
PILM4	48.2N	088.4W	0709	9.1					10.0	E	27.8	25/12	1013.7
POTA2	61.1N	146.7W	1427	12.1					7.1	SW	25.4	04/13	1011.3
PTAC1	39.0N	123.7W	0716	12.1					12.9	N	26.1	13/03	1013.6
PTAT2	27.8N	097.1W	0714	27.0	28.4				12.1	SE	28.8	21/23	1011.8
PTGC1	34.6N	120.7W	0711	13.6					16.2	N	29.2	06/04	1013.2
ROAM4	47.9N	089.3W	0717	12.1					11.4	SW	29.8	25/16	1012.3
SANF1	24.5N	081.9W	0711	27.7	28.7				10.0	E	27.2	14/02	1014.5
SAUF1	29.9N	081.3W	0713	24.4	25.0				9.0	SW	24.7	04/20	1014.8
SBIO1	41.6N	082.8W	0712	19.6					8.5	NE	37.8	22/01	1013.8
SGNW3	43.8N	087.7W	0714	15.2	11.8				8.8	S	27.5	25/00	1013.6
SISW1	48.3N	122.9W	0713	12.4					9.1	W	26.5	24/01	1015.2
SMKF1	24.6N	081.1W	0715	28.1	29.3				10.9	E	34.1	09/17	1014.7
SPGF1	26.7N	079.0W	0713	27.2	28.9				5.4	S	24.7	15/00	1015.4
SRST2	29.7N	094.1W	0717	27.0					9.8	S	27.1	19/20	1013.0
STDM4	47.2N	087.2W	0713	13.3					12.9	S	37.8	25/02	1012.5
SUPN6	44.5N	075.8W	0710	18.2	15.0				7.7	SW	27.6	25/17	1015.4
THIN6	44.3N	076.0W	0709	18.1									
TPLM2	38.9N	076.4W	0715	21.0	21.0				9.7	S	25.5	26/21	1015.8
TTIW1	48.4N	124.7W	0709	13.2					9.7	SW	30.3	04/02	1015.7
VENF1	27.1N	082.5W	0712	26.2	29.3				8.1	E	18.8	13/09	1015.1
WPOW1	47.7N	122.4W	0710	13.9					8.6	S	27.1	18/03	1015.8

JULY 1997

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
41001	34.7N	072.6W	0737	25.2	25.7	1.4	2.6	29/14	10.8	S	23.3	29/12	1016.3
41002	32.3N	075.2W	0736	26.5	27.3	1.2	2.6	01/08	11.0	SW	22.5	01/01	1016.0
41004	32.5N	079.1W	0734	27.1		0.9	2.7	31/16	10.3	SW	25.6	31/16	1015.3
41008	31.4N	080.9W	0739	27.4	28.1	0.7	2.4	31/23	10.4	S	26.4	31/22	1016.2
41009	28.5N	080.2W	1331	27.9	28.6	0.6	1.4	11/02	8.0	S	27.2	26/23	1016.6
41010	28.9N	078.5W	1466	27.8	28.4	0.8	1.4	27/10	8.3	S	25.3	05/23	1015.7
42001	25.9N	089.7W	0737	28.8	29.9	0.4	1.3	17/15	6.9	S	22.0	18/09	1017.1
42002	25.9N	093.6W	0744	28.9	29.9	0.5	1.5	16/17	7.9	SE	23.7	07/19	1016.3
42003	25.9N	085.9W	0726	29.2	30.1	0.5	1.1	19/10	6.0	E	19.6	05/21	1016.5
42007	30.1N	088.8W	0741	28.1	29.3	0.4	3.2	18/20	9.0	W	35.4	18/22	1015.1
42035	29.3N	094.4W	0741	29.1	30.1	0.5	1.4	14/23					1015.6
42036	28.5N	084.5W	0731	28.7	29.4	0.5	2.0	19/14	6.8	SW	21.2	05/17	1017.1
42039	28.8N	086.0W	0735	28.6	29.6	0.6	2.8	19/18	7.6	SW	23.9	19/07	1016.8
42040	29.2N	088.3W	0737	28.1	29.2	0.5	3.3	18/14	8.5	SW	31.7	18/23	1016.6

Continued on Page 90

Continued from Page 89

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
44004	38.5N	070.7W	0733	23.3	23.6	1.1	3.2	25/12	9.6	SW	31.1	25/08	1015.6
44005	42.9N	069.0W	0383	17.4	16.2	0.9	2.6	26/02	9.2	SW	22.3	19/19	1013.3
44007	43.5N	070.2W	0743	17.2	15.1	0.6	1.8	26/04					1012.5
44008	40.5N	069.4W	0333	17.5	16.7	1.1	5.1	25/15	9.6	SW	28.8	25/18	1013.9
44009	38.5N	074.7W	0735	23.3	23.4	0.9	2.9	25/06	9.7	S	26.0	25/04	1014.7
44011	41.1N	066.6W	0727	17.7	15.8	1.2	4.7	25/21	7.7	SW	17.7	26/17	1014.1
44013	42.4N	070.7W	0147	19.2		0.4	0.8	05/01	8.6	SW	22.5	04/03	1010.4
44014	36.6N	074.8W	0742	24.3	24.4	0.9	3.3	24/21	9.1	SW	42.0	24/20	1015.5
44025	40.3N	073.2W	0714	22.2	22.2	0.9	3.1	24/23	10.7	S	29.9	24/18	1014.9
45001	48.1N	087.8W	0732	6.9	3.6	0.4	2.1	02/21	7.8	SW	26.6	02/16	1015.2
45002	45.3N	086.4W	0734	16.8	16.0	0.5	1.5	02/19	9.1	S	25.3	02/18	1014.4
45003	45.3N	082.8W	0732	14.6	12.9	0.4	1.6	04/02	7.8	W	21.2	08/21	1015.0
45004	47.6N	086.6W	0741	6.8	3.5	0.4	1.6	02/15	7.8	W	27.0	02/17	1016.0
45005	41.7N	082.4W	0739	21.9	22.0	0.5	1.3	22/18	8.9	SW	23.7	07/02	1015.7
45006	47.3N	089.9W	0740	9.5	5.9	0.4	1.6	02/09	7.5	SW	23.9	02/09	1015.5
45007	42.7N	087.0W	0733	18.5	17.7	0.5	1.8	28/21	8.8	N	24.1	17/05	1014.9
45008	44.3N	082.4W	0737	16.8	15.9	0.5	1.9	29/00	7.7	S	31.1	15/01	1015.5
46001	56.3N	148.2W	0730	13.1	13.7	1.4	3.1	02/07	10.6	W	24.9	17/06	1016.1
46002	42.5N	130.3W	0727	15.9	16.7				10.0	N	23.1	25/13	1021.1
46003	51.9N	155.9W	0736	11.4	11.5	1.6	4.0	17/16	10.9	W	24.5	16/05	1013.5
46005	46.1N	131.0W	0732	14.6	15.2	1.4	4.2	08/03	9.9	W	24.7	08/00	1020.8
46006	40.9N	137.5W	0045	14.7	15.3	1.2	1.7	03/12	9.6	SW	15.9	02/17	1019.6
46011	34.9N	120.9W	0741	14.4	15.2	1.5	2.8	02/13	9.0	NW	24.1	07/01	1013.7
46012	37.4N	122.7W	0241	13.4		1.8	3.3	11/01	9.9	NW	20.6	02/08	1013.7
46014	39.2N	124.0W	0741	13.1	12.2	1.9	3.5	07/23	11.6	NW	28.2	11/02	1014.2
46022	40.7N	124.5W	0733	13.6	13.0	1.7	4.1	26/07	8.6	N	21.4	28/14	1016.4
46023	34.7N	121.0W	0667	14.7	15.3	1.4	2.7	11/10	10.5	NW	27.0	02/07	1014.5
46025	33.8N	119.1W	0148	19.0	20.5	1.0	1.9	01/02	5.9	W	13.2	04/14	1010.3
46026	37.8N	122.8W	0743	12.7	12.8	1.5	3.5	11/02	9.4	NW	25.5	09/09	1013.8
46028	35.7N	121.9W	0390	13.8	13.3	1.9	3.0	02/06	14.7	NW	28.8	06/04	1013.7
46029	46.2N	124.2W	0740		14.6	1.2	3.1	09/01	10.0	N	21.6	27/11	1018.6
46030	40.4N	124.5W	0737	12.6	11.1	1.6	3.4	26/07	12.2	N	21.2	28/14	1016.6
46035	56.9N	177.8W	0731	8.1	8.7	1.0	2.4	16/17	10.5	SW	20.4	19/00	1013.3
46042	36.8N	122.4W	0740		13.5	1.7	3.8	11/03					1014.9
46045	33.8N	118.5W	0739	18.7	20.9	0.7	1.8	01/02					1012.6
46054	34.3N	120.5W	0729	14.7	15.5	1.5	2.8	07/02	14.8	NW	30.3	06/23	1013.2
46059	38.0N	130.0W	0733	18.0	18.5	1.6	3.7	26/14	11.7	N	22.5	25/23	1022.1
46060	60.6N	146.8W	1466	14.1	14.8	0.3	1.3	12/03	6.8	E	22.2	12/04	1012.4
46061	60.2N	146.8W	1468		14.1	0.8	3.3	11/21	8.3	E	34.0	12/00	1012.5
46062	35.1N	121.0W	0543	14.7	15.2	1.4	2.6	10/07	7.4	NW	22.0	18/11	1014.4
51001	23.4N	162.3W	0744	25.9	26.7	2.1	3.6	01/00	14.0	NE	21.1	09/06	1018.5
51002	17.2N	157.8W	0743	26.3	26.7	2.2	3.7	01/03	16.0	E	26.8	31/00	1013.8
51003	19.1N	160.8W	0742	26.3	27.1	2.0	3.6	01/13	13.0	NE	22.0	31/11	1013.7
51004	17.4N	152.5W	0735	25.6		2.2	3.9	23/00	14.3	NE	24.0	01/09	1014.3
91222	18.1N	145.8E	0160	28.6									1009.4
91251	11.4N	162.4E	0730	28.9					11.8	E	24.7	11/13	1008.6
91328	8.6N	149.7E	0539	27.7					5.7	NE	25.2	31/06	1008.4
91343	7.6N	155.2E	0730	28.0									1008.1
91352	6.2N	160.7E	0406	27.7					3.7	E	18.6	12/08	1009.4
91374	8.7N	171.2E	0740	28.0					5.0	NE	14.0	24/13	1009.4
91377	6.1N	172.1E	0460	28.2									1011.6
91411	8.3N	137.5E	0311	28.0									1008.4
91442	4.6N	168.7E	0736	28.2					6.4	NE	22.9	14/12	1009.1
ABAN6	44.3N	075.9W	0734	20.2	20.4				3.3	S	12.1	09/05	1014.6
ALSN6	40.5N	073.8W	0739	22.1		0.6	3.1	25/05	14.2	S	36.9	09/20	1014.8
BLIA2	60.8N	146.9W	1468	12.9					5.9	NW	17.4	11/21	1013.2
BURL1	28.9N	089.4W	0737	28.3					9.9	W	41.2	18/10	1015.8
BUZM3	41.4N	071.0W	0738	20.1	18.3	0.7	1.7	25/23	13.4	SW	40.3	25/23	1015.0
CARO3	43.3N	124.4W	0734	14.1					7.3	NE	24.1	11/22	1018.3
CDRF1	29.1N	083.0W	0742	28.4					7.0	SW	22.7	06/01	1016.8
CHLV2	36.9N	075.7W	0737	24.7	24.5	0.7	2.1	25/00	10.9	S	44.9	24/21	1016.0
CLKN7	34.6N	076.5W	0738	26.3					10.2	SW	26.8	06/04	1016.8
CSBF1	29.7N	085.4W	0736	28.4					7.6	SW	25.3	18/18	1016.7
DBLN6	42.5N	079.4W	0734	20.6					8.3	SW	32.7	03/19	1015.9
DISW3	47.1N	090.7W	0730	15.9					8.9	SW	26.4	02/02	1015.3
DPIA1	30.3N	088.1W	0712	27.9	29.4				8.7	SW	63.5	19/12	1015.6
DRYF1	24.6N	082.9W	0274	29.1	30.1				6.6	E	14.3	07/12	1016.6
DSLN7	35.2N	075.3W	0737	26.0		1.0	2.0	31/16	14.9	SW	37.8	24/19	1015.4
DUCN7	36.2N	075.8W	0733	25.3		0.5	1.1	05/23	9.8	SW	41.5	24/20	1016.9
FBIS1	32.7N	079.9W	0741	27.2					8.4	SW	23.1	24/04	1016.5
FFIA2	57.3N	133.6W	0734	12.9					7.2	S	21.1	06/22	1015.2
FPSN7	33.5N	077.6W	0733	26.5		1.0	2.3	31/00	13.4	SW	29.5	30/20	1015.0
FWYF1	25.6N	080.1W	0733	28.8	30.1				9.2	SE	28.7	02/19	1017.5
GDIL1	29.3N	090.0W	0732	28.4	30.7				7.9	W	53.0	18/09	1016.1
GLLN6	43.9N	076.5W	0738	20.0					11.2	W	36.0	04/16	1014.7
IOSN3	43.0N	070.6W	0735	19.1					12.1	W	34.2	04/02	1012.9
KTNF1	29.8N	083.6W	0739	27.6					7.4	SW	19.1	05/18	1016.2
LKWF1	26.6N	080.0W	0731	27.9	29.4				7.4	SE	23.5	02/20	1017.0
LONF1	24.9N	080.9W	0732	29.2	31.0				7.4	SE	27.1	22/16	1016.9
LPOI1	48.1N	116.5W	0527	19.6	19.3				5.2	S	25.4	22/01	1015.0
MDRM1	44.0N	068.1W	0734	14.5					13.3	SW	26.5	09/13	1012.7
MISM1	43.8N	068.9W	0732	15.5					13.7	SW	29.7	19/01	1012.5
MLRF1	25.0N	080.4W	0737	28.7	29.8				7.7	SE	21.3	22/15	1017.4
NWPO3	44.6N	124.1W	0736	13.8					8.6	N	31.1	27/01	1018.7
PILM4	48.2N	088.4W	0729	11.3					10.5	W	35.6	02/19	1016.3

Continued on Page 91

Continued from Page 90

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
POTA2	61.1N	146.7W	1472	12.5					7.0	N	19.6	11/18	1012.8
PTAC1	39.0N	123.7W	0738	12.7					10.4	N	24.8	08/07	1014.3
PTAT2	27.8N	097.1W	0737	28.0	30.2				11.5	SE	20.5	01/01	1015.5
PTGC1	34.6N	120.7W	0734	14.1					13.7	N	31.6	01/14	1014.7
ROAM4	47.9N	089.3W	0736	14.2					11.2	SW	36.4	02/13	1015.1
SANF1	24.5N	081.9W	0730	29.0	29.8				7.4	E	19.5	31/06	1017.1
SAUF1	29.9N	081.3W	0733	26.3	27.8				7.2	SW	26.9	10/00	1017.1
SBIO1	41.6N	082.8W	0731	22.3					8.1	NE	26.7	04/06	1015.2
SGNW3	43.8N	087.7W	0739	18.2					8.9	N	28.3	14/08	1015.8
SISW1	48.3N	122.9W	0736	13.3					10.4	SW	31.7	05/15	1017.5
SMKF1	24.6N	081.1W	0738	29.3	30.2				8.0	E	32.0	22/16	1017.3
SPGF1	26.7N	079.0W	0737	28.5	30.2				4.5	S	18.6	19/18	1018.1
SRST2	29.7N	094.1W	0333	28.8					10.1	S	25.7	06/15	1016.8
STDM4	47.2N	087.2W	0736	14.2					13.4	W	44.1	02/12	1015.3
SUPN6	44.5N	075.8W	0735	20.2	20.8				9.3	SW	28.1	03/18	1015.6
THIN6	44.3N	076.0W	0736	19.9									
TPLM2	38.9N	076.4W	0733	24.9	25.6				10.2	S	25.2	23/23	1015.8
TTIW1	48.4N	124.7W	0732	14.2					8.0	SW	23.6	08/15	1018.5
VENF1	27.1N	082.5W	0734	27.3	31.3				6.6	E	19.5	02/10	1017.8
WPOW1	47.7N	122.4W	0734	15.6					7.4	N	22.1	06/23	1018.0

AUGUST 1997

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
41001	34.7N	072.6W	0738	25.5	26.8	1.3	2.6	18/23	11.0	SW	24.5	08/04	1016.0
41002	32.3N	075.2W	0734	26.4	27.3	1.2	3.5	28/12	10.3	SW	29.0	28/16	1015.7
41004	32.5N	079.1W	0740	26.9		0.9	2.4	01/02	11.1	NE	21.8	01/21	1015.8
41008	31.4N	080.9W	0737	27.4	28.7	0.8	2.0	01/00	11.1	NE	22.3	24/05	1016.4
41009	28.5N	080.2W	1439	27.9	29.1	0.7	1.4	28/16	7.7	SW	27.2	03/22	1016.4
41010	28.9N	078.5W	1471	28.0	29.1	0.9	1.7	22/11	8.2	S	31.3	26/11	1015.2
42001	25.9N	089.7W	0743	28.9	30.2	0.5	1.8	28/03	7.9	E	22.0	02/14	1017.1
42002	25.9N	093.6W	0741	29.3	30.4	0.5	1.2	16/10	8.5	SE	20.8	23/18	1016.3
42003	25.9N	085.9W	0736	29.4	30.3	0.6	1.5	26/23	7.3	E	23.1	27/13	1016.3
42007	30.1N	088.8W	0737	28.2	29.3	0.3	1.0	01/08	8.3	SW	20.6	01/07	1016.2
42035	29.3N	094.4W	0741	29.3	30.2	0.6	1.7	09/10					1015.9
42036	28.5N	084.5W	0742	28.7	29.7	0.5	1.7	02/14	7.3	W	21.8	05/10	1017.2
42039	28.8N	086.0W	0736	28.4	29.5	0.5	2.5	02/23	7.5	W	23.1	01/22	1017.1
42040	29.2N	088.3W	0737	28.6	29.8	0.5	1.5	01/14	7.2	SW	18.8	01/22	1017.3
44004	38.5N	070.7W	0735	23.0	23.8	1.1	2.6	21/17	8.8	SW	22.0	21/13	1016.1
44005	42.9N	069.0W	0729	18.0	17.3	0.9	3.4	22/06	9.0	SW	30.3	22/03	1014.6
44007	43.5N	070.2W	0741	17.0	15.8	0.7	4.0	22/04					1014.0
44008	40.5N	069.4W	0736	18.9	18.7	1.0	4.0	21/23	7.7	SW	24.3	21/15	1015.4
44009	38.5N	074.7W	0740	22.9	23.5	0.8	3.1	21/03	8.6	S	29.3	21/00	1015.6
44011	41.1N	066.6W	0726	17.7	16.5	1.2	4.2	22/07	8.2	SW	26.8	09/05	1015.7
44014	36.6N	074.8W	0741	24.4	25.0	0.9	2.1	19/05	8.9	NE	24.3	21/05	1016.3
44025	40.3N	073.2W	0715	21.9	22.3	0.9	3.8	21/07	9.2	SW	29.9	21/07	1015.9
45001	48.1N	087.8W	0731	12.3	10.7	0.4	1.4	16/15	8.4	SW	18.8	15/07	1015.5
45002	45.3N	086.4W	0732	17.5	18.1	0.6	2.3	15/09	11.0	S	25.1	15/09	1015.0
45003	45.3N	082.8W	0736	16.3	16.2	0.6	2.6	15/17	9.7	S	24.5	14/00	1015.5
45004	47.6N	086.6W	0740	9.9	7.3	0.4	1.2	15/09	7.6	S	19.8	15/06	1016.5
45005	41.7N	082.4W	0734	20.6	21.3	0.5	1.3	22/14	9.9	SW	25.1	16/13	1016.0
45006	47.3N	089.9W	0739	15.5	14.7	0.4	1.2	16/17	8.6	SW	21.4	16/16	1015.8
45007	42.7N	087.0W	0735	19.3	20.4	0.6	2.6	05/05	10.2	S	25.3	05/04	1015.2
45008	44.3N	082.4W	0734	17.6	18.1	0.6	3.0	22/13	10.5	N	25.6	22/12	1015.9
45011	43.0N	086.3W	0437	17.3	17.5				9.1	NW	23.3	21/20	1014.6
46001	56.3N	148.2W	0738	14.4	14.8	1.9	4.9	12/10	12.0	SW	27.4	12/06	1014.9
46002	42.5N	130.3W	0737	17.5	18.3	2.0	3.7	15/06	12.8	N	24.7	09/11	1016.7
46003	51.9N	155.9W	0735	12.9	12.7	2.1	5.1	12/05	13.0	S	30.3	11/01	1018.1
46005	46.1N	131.0W	0737	16.5	17.0	1.8	4.0	15/21	11.8	NW	24.3	16/00	1017.1
46011	34.9N	120.9W	0736	16.7	16.9	1.5	2.6	06/10	10.7	NW	25.3	20/03	1013.9
46014	39.2N	124.0W	0740	15.2	15.2	1.5	3.3	07/00	7.0	NW	23.1	06/15	1015.1
46022	40.7N	124.5W	0734	14.5	14.3	1.5	4.2	08/03	7.0	N	22.7	06/09	1015.9
46023	34.7N	121.0W	0733	17.1	17.7	1.6	3.0	06/08	13.7	NW	26.6	29/00	1014.8
46026	37.8N	122.8W	0736	15.5	16.0	1.2	2.3	07/07	9.4	NW	21.6	05/23	1014.6
46029	46.2N	124.2W	0742		15.7	1.4	3.9	15/11	8.8	S	23.5	26/12	1016.1
46030	40.4N	124.5W	0738	14.0	12.9	1.5	3.7	08/07	9.0	N	22.5	06/15	1016.3
46035	56.9N	177.8W	0732	9.9	10.5	1.4	3.8	04/00	12.8	S	31.1	03/14	1012.7
46042	36.8N	122.4W	0742		16.1	1.4	2.7	07/01					1015.2
46045	33.8N	118.5W	0738	20.1	21.2	0.9	1.5	28/07					1012.7
46054	34.3N	120.5W	0726	17.0	18.0	1.4	2.6	06/10	16.2	NW	29.5	06/04	1013.4
46059	38.0N	130.0W	0738	19.3	19.6	1.8	3.9	09/00	11.3	N	23.5	08/17	1018.7
46060	60.6N	146.8W	1471	14.6	15.6	0.4	1.5	10/12	8.3	E	30.1	31/11	1014.6
46061	60.2N	146.8W	1460		15.1	0.9	2.9	12/02	8.6	E	28.4	09/07	1014.7
46062	35.1N	121.0W	0720	16.8	17.1	1.4	2.7	06/09	12.4	NW	26.2	20/03	1014.1
51001	23.4N	162.3W	0738	26.7	27.6	2.0	3.0	01/00	11.0	NW	19.4	01/00	1017.8
51002	17.2N	157.8W	0738	26.6	27.1	1.9	3.0	01/12	14.1	E	24.6	02/22	1014.3
51003	19.1N	160.8W	0739	27.0	27.8	1.7	2.8	01/03	9.9	NE	18.4	01/00	1013.8
51004	17.4N	152.5W	0734	26.2		2.0	3.5	09/22	13.2	NE	22.3	01/15	1014.4
91222	18.1N	145.8E	0053	28.2									1008.5
91251	11.4N	162.4E	0721	28.1					10.9	W	28.7	07/19	1008.7
91328	8.6N	149.7E	0545	27.4					9.7	SW	25.2	09/21	1009.1
91343	7.6N	155.2E	0728	27.4									1009.3
91352	6.2N	160.7E	0404	27.3									1011.6
91374	8.7N	171.2E	0731	27.5					4.1	E	10.9	14/00	1009.6
91377	6.1N	172.1E	0496	27.6									1012.4

Continued on Page 92

Continued from Page 91

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
91411	8.3N	137.5E	0358	27.6									1009.4
91442	4.6N	168.7E	0741	27.5					10.4	W	34.9	13/12	1010.4
ABAN6	44.3N	075.9W	0734	19.0	20.8				2.9	S	12.0	15/19	1015.6
ALSN6	40.5N	073.8W	0735	22.1		0.7	3.6	21/02	11.7	SW	44.2	21/07	1015.6
BLIA2	60.8N	146.9W	1475	12.9					7.3	NW	28.9	12/03	1015.3
BURL1	28.9N	089.4W	0740	29.1					7.9	S	20.9	02/00	1016.5
BUZM3	41.4N	071.0W	0739	19.7	18.9	0.6	2.5	21/22	11.4	SW	39.2	21/11	1016.1
CARO3	43.3N	124.4W	0738	15.4					7.6	NE	27.1	25/22	1016.4
CDRF1	29.1N	083.0W	0741	27.8					7.4	W	22.8	24/21	1016.9
CHLV2	36.9N	075.7W	0339	24.6	25.1	0.6	1.0	10/00	8.9	S	32.1	04/21	1018.7
CLKN7	34.6N	076.5W	0740	25.7					10.8	NE	41.5	18/22	1017.5
CSBF1	29.7N	085.4W	0735	27.9					7.1	W	23.0	03/05	1017.0
DBLN6	42.5N	079.4W	0739	19.6					8.4	SW	28.8	22/19	1016.1
DISW3	47.1N	090.7W	0733	17.0					8.6	SW	22.3	20/14	1015.9
DPIA1	30.3N	088.1W	0740	27.9	29.7				8.2	N	22.6	22/06	1016.9
DRYF1	24.6N	082.9W	0226	29.2	31.1				5.3	NE	24.2	30/09	1015.2
DSLN7	35.2N	075.3W	0737	25.3		1.0	2.2	25/13	14.6	NE	34.7	18/00	1016.0
DUCN7	36.2N	075.8W	0728	24.9		0.5	1.2	19/08	9.3	NE	26.9	14/23	1017.8
FBIS1	32.7N	079.9W	0743	26.5					8.9	SW	18.4	01/02	1017.2
FFIA2	57.3N	133.6W	0736	13.4					6.9	N	23.3	22/14	1016.9
FPSN7	33.5N	077.6W	0737	26.1		1.0	2.0	01/03	13.6	NE	25.6	01/06	1015.4
FWYF1	25.6N	080.1W	0739	29.1	30.7				8.9	E	31.8	04/00	1017.3
GDIL1	29.3N	090.0W	0739	28.9	31.2				7.1	S	21.4	06/21	1016.9
GLLN6	43.9N	076.5W	0739	19.8					10.1	W	27.6	21/17	1015.3
IOSN3	43.0N	070.6W	0739	18.9					10.7	S	34.6	21/19	1014.3
KTNF1	29.8N	083.6W	0740	26.7					7.4	NE	21.6	08/01	1016.5
LKWF1	26.6N	080.0W	0727	28.1	30.1				6.7	SE	22.6	21/20	1016.8
LONF1	24.9N	080.9W	0738	29.4	31.6				7.0	SE	24.7	23/18	1016.6
LPOI1	48.1N	116.5W	0222	20.6	21.4				3.9	N	27.2	02/09	1017.0
MDRM1	44.0N	068.1W	0732	15.2					11.4	SW	35.3	22/10	1014.6
MISM1	43.8N	068.9W	0741	15.5					11.8	SW	32.4	22/02	1014.3
MLRF1	25.0N	080.4W	0732	29.1	30.7				7.6	SE	27.2	24/06	1017.0
NWPO3	44.6N	124.1W	0737	14.9					7.3	S	25.3	28/21	1016.7
PILM4	48.2N	088.4W	0737	14.9					10.7	W	28.8	01/06	1016.8
POTA2	61.1N	146.7W	1471	11.8					9.2	N	23.5	14/12	1015.1
PTAC1	39.0N	123.7W	0740	14.9					7.4	N	22.8	07/07	1015.1
PTAT2	27.8N	097.1W	0741	28.1	29.7				11.7	SE	22.9	07/22	1015.5
PTGC1	34.6N	120.7W	0735	16.6					15.1	N	30.2	06/09	1014.9
ROAM4	47.9N	089.3W	0737	15.4					11.0	SW	27.8	09/06	1015.7
SANF1	24.5N	081.9W	0734	29.3	30.7				7.5	E	20.6	02/01	1016.8
SAUF1	29.9N	081.3W	0741	26.9	28.6				8.2	SW	27.3	01/11	1017.0
SBIO1	41.6N	082.8W	0730	20.7					8.7	SW	35.6	24/19	1015.5
SGNW3	43.8N	087.7W	0737	18.5					9.8	S	25.9	05/02	1016.3
SISW1	48.3N	122.9W	0742	14.3					7.3	SW	25.6	08/06	1015.7
SMKF1	24.6N	081.1W	0737	29.5	31.0				8.0	E	23.3	10/17	1017.0
SPGF1	26.7N	079.0W	0734	28.7	30.6				4.4	SW	16.4	09/03	1017.9
SRST2	29.7N	094.1W	0698	28.3					9.8	S	27.4	22/23	1016.9
STDM4	47.2N	087.2W	0735	15.2					12.3	NW	25.6	15/06	1016.2
SUPN6	44.5N	075.8W	0731	19.0	21.1				7.6	SW	23.6	16/06	1015.5
THIN6	44.3N	076.0W	0737	18.8									
TPLM2	38.9N	076.4W	0733	23.7	25.0				8.9	S	26.4	18/15	1016.7
TTIW1	48.4N	124.7W	0733	15.0					8.7	S	23.1	15/04	1016.2
VENF1	27.1N	082.5W	0738	27.8	31.5				6.5	E	23.6	22/17	1017.5
WPOW1	47.7N	122.4W	0733	16.6					6.8	NE	21.4	27/02	1016.1

SEPTEMBER 1997

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
41001	34.7N	072.6W	0716	24.6	26.1	1.4	3.6	29/06					1015.5
41002	32.3N	075.2W	0718	25.8	27.0	1.4	3.7	04/14	10.1	S	25.3	25/23	1014.9
41004	32.5N	079.1W	0713	26.0		1.1	3.1	04/13	10.4	NE	27.2	04/12	1014.2
41008	31.4N	080.9W	0707	26.7	27.9	0.9	2.8	04/15	10.9	NE	28.2	04/13	1014.7
41009	28.5N	080.2W	1431	27.4	28.8	1.1	3.1	05/09	10.6	NE	25.1	27/09	1014.3
41010	28.9N	078.5W	1428	27.0	28.2	1.3	3.1	05/06	11.2	NE	26.0	27/10	1014.1
42001	25.9N	089.7W	0715	27.9	29.2	0.7	1.9	26/03	9.5	E	22.0	21/21	1014.1
42002	25.9N	093.6W	0720	28.4	29.8	0.7	2.0	22/07	10.2	E	29.3	22/06	1013.4
42003	25.9N	085.9W	0715	28.4	29.3	0.6	2.2	06/11	8.6	E	23.7	06/11	1013.5
42007	30.1N	088.8W	0718	27.2	28.7	0.4	1.7	05/20	8.7	N	24.9	25/10	1014.0
42035	29.3N	094.4W	0720	27.9	29.3	0.6	2.2	22/00					1013.7
42036	28.5N	084.5W	0718	27.9	28.8	0.5	2.3	05/16	7.8	E	22.2	05/13	1014.9
42039	28.8N	086.0W	0715	27.7	28.8	0.6	2.5	05/15	7.9	E	21.6	05/12	1014.8
42040	29.2N	088.3W	0711	27.6	29.0	0.6	2.1	06/06	7.9	E	23.1	25/14	1015.0
44004	38.5N	070.7W	0714	21.8	23.5	1.5	3.6	29/11	10.1	SW	25.6	21/05	1015.3
44005	42.9N	069.0W	0713	15.6	15.9	1.1	4.1	30/06	11.5	SW	27.4	21/00	1013.5
44007	43.5N	070.2W	0719	14.4	13.9	0.7	2.0	29/14					1012.9
44008	40.5N	069.4W	0714	18.5	19.4	1.2	4.0	29/19	9.6	SW	27.4	21/03	1014.3
44009	38.5N	074.7W	0711	20.8	21.8	1.0	2.6	28/21	11.4	S	31.7	21/01	1014.8
44011	41.1N	066.6W	0707	18.1	19.0	1.3	3.9	30/02	10.2	SW	29.1	21/05	1014.8
44014	36.6N	074.8W	0719	22.5	23.0	1.1	3.2	21/10	9.9	SW	29.3	21/04	1015.4
44025	40.3N	073.2W	0711	19.4	20.1	1.0	3.0	29/16	12.0	SW	26.4	21/02	1015.0
45001	48.1N	087.8W	0714	13.1	12.4	0.9	4.6	24/19	12.7	SW	31.9	24/18	1012.5
45002	45.3N	086.4W	0709	15.5	16.0	0.9	3.1	19/04	14.2	N	29.5	19/06	1013.2
45003	45.3N	082.8W	0705	14.7	15.3	0.8	2.3	17/09	12.3	S	27.8	30/19	1013.5
45004	47.6N	086.6W	0718	12.2	11.2	0.9	2.9	24/17	12.1	N	26.4	30/12	1013.5
45005	41.7N	082.4W	0718	18.4	19.6	0.6	1.6	04/03	10.9	SW	28.2	29/22	1015.3
45006	47.3N	089.9W	0718	14.9	14.9	0.8	2.9	28/18	11.7	SW	33.8	28/17	1015.7
45007	42.7N	087.0W	0705	17.3	18.4	0.9	3.1	02/23	12.0	N	31.5	19/19	1014.4

Continued on Page 93

Continued from Page 92

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
45008	44.3N	082.4W	0712	15.8	16.3	0.8	2.3	21/00	11.9	N	25.3	20/22	1014.2
45011	43.0N	086.3W	0716	16.6	17.5	0.7	3.2	30/06	10.9	NW	31.1	30/04	1015.4
46001	56.3N	148.2W	0429	13.8	14.5	2.1	4.9	08/16	13.2	NW	26.8	17/20	1008.0
46002	42.5N	130.3W	0715	17.3	18.3	2.5	7.6	26/18	13.0	W	27.8	17/01	1014.5
46003	51.9N	155.9W	0699	11.6	12.2	2.8	7.0	07/18	15.7	W	29.3	21/01	1005.7
46005	46.1N	131.0W	0714	16.2	16.9	2.6	9.6	26/14	14.0	W	34.6	26/12	1013.1
46011	34.9N	120.9W	0712	17.6	18.0	1.9	4.6	27/18	10.9	NW	22.7	12/00	1011.1
46014	39.2N	124.0W	0712	15.7	15.4	2.1	5.9	27/17	9.0	NW	25.8	28/00	1012.8
46022	40.7N	124.5W	0709	16.7	16.7	2.0	6.2	27/07	10.5	N	24.5	13/21	1013.9
46023	34.7N	121.0W	0709	17.8	18.5	1.9	5.5	27/21	14.6	NW	28.6	12/01	1012.1
46026	37.8N	122.8W	0717	15.9	16.1	1.7	4.3	27/13	9.9	NW	24.9	27/03	1012.1
46029	46.2N	124.2W	0719		17.1	2.0	6.6	27/03	11.9	S	35.2	14/20	1013.0
46030	40.4N	124.5W	0716	14.8	13.3	1.9	5.5	27/05	9.7	N	22.5	13/23	1014.3
46035	56.9N	177.8W	0703	8.7	9.6	2.3	5.3	06/20	16.2	SW	35.0	06/18	1006.4
46042	36.8N	122.4W	0720		17.1	2.0	4.8	27/19					1012.7
46045	33.8N	118.5W	0716	21.1	21.8	0.9	1.9	11/09					1009.7
46050	44.6N	124.5W	0608	17.2	17.9	2.4	7.4	27/01	10.5	N	31.5	17/04	1012.4
46054	34.3N	120.5W	0681	17.8	18.6	1.9	4.0	26/06	16.9	NW	27.4	10/08	1010.5
46059	38.0N	130.0W	0716	19.3	20.3	2.2	6.6	26/22	12.0	NW	21.4	13/13	1017.2
46060	60.6N	146.8W	1430	12.3	13.4	0.6	2.4	18/05	11.6	E	36.7	18/04	1005.2
46061	60.2N	146.8W	1420	12.3	13.4	1.3	5.3	22/17	12.5	E	40.6	22/15	1005.0
46062	35.1N	121.0W	0704	17.6	17.9	1.8	4.1	28/03	11.9	NW	24.5	11/00	1011.3
51001	23.4N	162.3W	0719	27.0	27.9	2.2	3.1	17/05	11.7	E	25.6	04/23	1017.4
51002	17.2N	157.8W	0719	26.7	27.6	2.1	4.2	24/13	13.1	NE	23.0	27/15	1013.9
51003	19.1N	160.8W	0718	27.0	28.0	1.9	4.2	24/09	9.9	NE	22.1	05/06	1013.2
51004	17.4N	152.5W	0715	26.4		2.1	4.4	24/17	13.0	NE	22.7	15/17	1013.9
91251	11.4N	162.4E	0321	29.0					10.9	NE	26.5	13/04	1006.2
91328	8.6N	149.7E	0529	27.5					9.9	SW	27.2	15/04	1009.9
91343	7.6N	155.2E	0714	27.5									1009.6
91352	6.2N	160.7E	0467	27.5									1011.8
91374	8.7N	171.2E	0712	27.4					4.2	SW	13.1	23/08	1009.6
91377	6.1N	172.1E	0496	27.7									1012.7
91411	8.3N	137.5E	0342	27.8									1010.6
91442	4.6N	168.7E	0715	27.5					9.4	W	34.9	03/14	1010.6
ABAN6	44.3N	075.9W	0715	15.1	18.0				3.5	S	14.0	17/19	1014.7
ALSN6	40.5N	073.8W	0715	19.3		0.7	2.1	29/11	14.8	SW	35.8	29/05	1015.0
BLIA2	60.8N	146.9W	1432	11.1					10.4	N	41.8	18/06	1006.0
BURL1	28.9N	089.4W	0714	28.1					9.3	E	22.8	06/18	1014.2
BUZM3	41.4N	071.0W	0713	17.6	18.2	0.7	3.1	29/23	13.4	SW	35.0	29/19	1015.3
CARO3	43.3N	124.4W	0711	16.4					8.3	N	32.3	15/19	1014.2
CDRF1	29.1N	083.0W	0716	27.1					7.6	NE	19.3	26/19	1014.6
CHLV2	36.9N	075.7W	0599	22.0	22.8	0.8	2.5	21/09	11.3	SW	37.9	21/04	1015.3
CLKN7	34.6N	076.5W	0714	24.4					10.4	SW	27.2	27/19	1016.5
CSBF1	29.7N	085.4W	0711	27.1					6.4	NE	20.2	25/19	1014.8
DBLN6	42.5N	079.4W	0713	16.9					10.0	SW	38.0	30/12	1015.3
DISW3	47.1N	090.7W	0706	15.4					8.9	SW	24.2	19/02	1013.5
DPIA1	30.3N	088.1W	0717	27.0	29.1				8.6	N	20.9	04/06	1014.7
DRYF1	24.6N	082.9W	0711	28.3	29.8				7.8	E	24.1	12/06	1013.6
DSLN7	35.2N	075.3W	0715	24.3		1.1	3.5	28/21	14.1	N	38.6	28/19	1014.7
DUCN7	36.2N	075.8W	0711	22.8		0.7	2.3	04/13	10.7	SW	32.5	21/08	1016.9
FBIS1	32.7N	079.9W	0715	25.3					8.6	SW	25.0	21/19	1015.6
FFIA2	57.3N	133.6W	0713	11.2					9.0	N	35.1	23/07	1009.4
FPSN7	33.5N	077.6W	0710	25.1		1.1	3.1	28/14	12.0	S	36.9	28/12	1014.1
FWYF1	25.6N	080.1W	0712	27.8	29.2				10.9	E	33.1	28/01	1014.7
GDIL1	29.3N	090.0W	0712	27.7	29.9				8.0	E	32.9	01/01	1014.6
GLLN6	43.9N	076.5W	0716	16.5					13.4	W	32.5	29/16	1014.3
IOSN3	43.0N	070.6W	0717	15.6					11.8	SW	31.6	29/21	1013.4
KTNF1	29.8N	083.6W	0716	25.9					7.0	NE	24.7	17/22	1014.3
LKWF1	26.6N	080.0W	0331	27.5	29.0				10.9	S	25.4	05/15	1013.6
LONF1	24.9N	080.9W	0715	28.0	29.1				8.7	E	28.8	27/22	1013.9
LPOI1	48.1N	116.5W	0717	16.0	17.9				6.3	NE	26.7	27/13	1015.2
MDRM1	44.0N	068.1W	0712	13.2					12.8	SW	32.5	29/21	1013.4
MISM1	43.8N	068.9W	0714	13.3					13.1	SW	37.4	29/15	1013.1
MLRF1	25.0N	080.4W	0706	27.9	29.6				9.4	E	30.0	28/23	1014.3
MRKA2	61.1N	146.7W	0546	7.5					7.0	NE	17.6	23/02	1001.7
NWPO3	44.6N	124.1W	0714	16.1					8.6	E	35.2	17/02	1014.2
PILM4	48.2N	088.4W	0714	13.6					13.3	N	34.7	24/20	1014.0
POTA2	61.1N	146.7W	1433	9.4					12.5	N	30.1	22/02	1006.0
PTAC1	39.0N	123.7W	0716	15.1					7.9	N	23.3	27/09	1012.8
PTAT2	27.8N	097.1W	0717	27.8	29.8				10.7	SE	21.3	22/09	1013.6
PTGC1	34.6N	120.7W	0712	17.2					15.2	N	27.2	15/20	1012.1
ROAM4	47.9N	089.3W	0716	14.0					14.1	SW	34.0	24/16	1012.9
SANF1	24.5N	081.9W	0715	28.0	29.3				9.5	E	29.7	27/22	1014.0
SAUF1	29.9N	081.3W	0716	26.3	28.5				8.4	E	26.1	04/17	1015.1
SBIO1	41.6N	082.8W	0711	18.2					9.6	W	35.0	29/01	1015.0
SGNW3	43.8N	087.7W	0715	16.4					10.9	S	28.8	17/03	1015.3
SISW1	48.3N	122.9W	0717	13.5					8.6	W	38.7	15/02	1013.0
SMKF1	24.6N	081.1W	0307	28.3	29.7				10.8	S	35.1	27/23	1013.9
SPGF1	26.7N	079.0W	0714	27.5	29.3				7.2	E	23.4	05/14	1015.4
SRST2	29.7N	094.1W	0619	26.6					9.8	SE	29.2	23/08	1014.4
STDM4	47.2N	087.2W	0716	14.0					16.4	N	36.7	30/08	1013.6
SUPN6	44.5N	075.8W	0714	15.3	18.5				10.1	SW	29.4	22/21	1014.3
THIN6	44.3N	076.0W	0709	15.2									
TPLM2	38.9N	076.4W	0714	20.7	22.8				10.5	S	28.7	21/01	1016.1
TTIW1	48.4N	124.7W	0715	15.5					12.8	E	42.8	26/21	1012.6
VENF1	27.1N	082.5W	0706	26.6	29.5				7.7	E	29.2	27/04	1015.1
WPOW1	47.7N	122.4W	0714	15.0					9.0	S	27.5	15/02	1013.6

Meteorological Services—Observations

U.S. Port Meteorological Officers

Headquarters

Vincent Zegowitz
Voluntary Observing Ships Program Leader
National Weather Service, NOAA
1325 East-West Hwy., Room 14112
Silver Spring, MD 20910
Tel: 301-713-1677 Ext. 129
Fax: 301-713-1598

Martin S. Baron
VOS Assistant Program Leader
National Weather Service, NOAA
1325 East-West Hwy., Room 14108
Silver Spring, MD 20910
Tel: 301-713-1677 Ext. 134
Fax: 301-713-1598

CDR. Tim Rulon
GMDSS Program Manager
National Weather Service, NOAA
1325 East-West Hwy., Room 14114
Silver Spring, MD 20910
Tel: 301-713-1677 Ext. 128
Fax: 301-713-1598
E-Mail: Timothy.Rulon@noaa.gov

Mary Ann Burke, Editor
Mariners Weather Log
3030 70th Avenue
Wilson, WI 54027
Tel and Fax: 715-772-3487
E-Mail: wvrs@discover-net.net

Atlantic Ports

Robert Drummond, PMO
National Weather Service, NOAA
2550 Eisenhower Blvd, No. 312
P.O. Box 165504
Port Everglades, FL 33316
Tel: 954-463-4271
Fax/Tel: 954-462-8963

Lawrence Cain, PMO
National Weather Service, NOAA
13701 Fang Rd.
Jacksonville, FL 32218
Tel: 904-741-5186

Peter Gibino, PMO, Norfolk
NWS-NOAA
200 World Trade Center
Norfolk, VA 23510
Tel: 757-441-3415
Fax: 757-441-6051

James Saunders, PMO
National Weather Service, NOAA
Maritime Center I, Suite 287
2200 Broening Hwy.
Baltimore, MD 21224-6623
Tel: 410-633-4709
Fax: 410-633-4713
E-mail: pmojim@erols.com

PMO
National Weather Service, NOAA
Bldg.51, Newark International Airport
Newark, NJ 07114
Tel: 973-645-6188
Fax: 973-623-8771

Tim Kenefick, PMO, New York
National Weather Service, NOAA
Bldg.51, Newark International Airport
Newark, NJ 07114
Tel: 973-645-6188
Fax: 973-623-8771

Great Lakes Ports

Amy Seeley, PMO
National Weather Service, NOAA
333 West University Dr.
Romeoville, IL 60441
Tel: 815-834-0600 Ext. 269
Fax: 815-834-0645

George Smith, PMO
National Weather Service, NOAA
Hopkins International Airport
Federal Facilities Bldg.
Cleveland, OH 44135
Tel: 216-265-2374
Fax: 216-265-2371
E-Mail: George.E.Smith@noaa.gov

Gulf of Mexico Ports

John Warrelmann, PMO
National Weather Service, NOAA
Int'l Airport, Moisant Field
Box 20026
New Orleans, LA 70141
Tel: 504-589-4839

James Nelson, PMO
National Weather Service, NOAA
Houston Area Weather Office
1620 Gill Road
Dickinson, TX 77539
Tel: 281-534-2640 x.277
Fax: 281-337-3798
E-mail: jim.nelson@noaa.gov

Pacific Ports

Derek Lee Loy
Ocean Services Program Coordinator
NWS Pacific Region HQ
Grosvenor Center, Mauka Tower
737 Bishop Street, Suite 2200
Honolulu, HI 96813-3213
Tel: 808-532-6439
Fax: 808-532-5569

Robert Webster, PMO
National Weather Service, NOAA
501 West Ocean Blvd., Room 4480
Long Beach, CA 90802-4213
Tel: 562-980-4090
Fax: 562-980-4089
Telex: 7402731/BOBW UC
E-mail: bob.webster@noaa.gov

Robert Novak, PMO
National Weather Service, NOAA
1301 Clay St., Suite 1190N
Oakland, CA 94612-5217
Tel: 510-637-2960
Fax: 510-637-2961
Telex: 7402795/WPMO UC
E-mail: w-wr-oak@noaa.gov

Patrick Brandow, PMO
National Weather Service, NOAA
7600 Sand Point Way, N.E.
Seattle, WA 98115-0070
Tel: 206-526-6100
Fax: 206-526-4571 or 6094
Telex: 7608403/SEA UC
E-Mail: pat.brandow@noaa.gov

Continued on Page 95

Meteorological Services

Continued from Page 94

Gary Ennen
National Weather Service, NOAA
600 Sandy Hook St., Suite 1
Kodiak, AK 99615
Tel: 907-487-2102
Fax: 907-487-9730

Lynn Chrystal, OIC
National Weather Service, NOAA
Box 427
Valdez, AK 99686
Tel: 907-835-4505
Fax: 907-835-4598

Greg Matzen, Marine Program Mgr.
W/AR1x2 Alaska Region
National Weather Service
222 West 7th Avenue #23
Anchorage, AK 99513-7575
Tel: 907-271-3507

SEAS Field Representatives

Mr. Robert Decker
Seas Logistics/ PMC
7600 Sand Point Way N.E.
Seattle, WA 98115
Tel: 206-526-4280
Fax: 206-526-6365
Telex: 7408535
E-Mail: bob.decker@noaa.gov

Mr. Steven Cook
SEAS Operations Manager
8604 La Jolla Shores Dr.
La Jolla, CA 92037
Tel: 619-546-7103
Fax: 619-546-7185
E-Mail: skcook@ucsd.edu

Mr. Robert Benway
National Marine Fisheries Service
28 Tarzwell Dr.
Narragansett, RI 02882
Tel: 401-782-3295
Fax: 401-782-3201

Mr. Jim Farrington
SEAS Logistics/ A.M.C.
439 WestWork St.
Norfolk, VA 23510
Tel: 804-441-3062
Fax: 804-441-6495

Mr. Warren Krug
Atlantic Oceanographic & Met. Lab.
4301 Rickenbacker Causeway
Miami, FL 33149
Tel: 305-361-4433
Fax: 305-361-4582
Telex: 744 7600 MCI

NIMA Fleet Liaison

Tom Hunter, Fleet Liaison Officer
ATTN: GIMM (MS D-44)
4600 Sangamore Road
Bethesda, MD 20816-5003
Tel: 301-227-3120
Fax: 301-227-4211

U.S. Coast Guard AMVER Center

Richard T. Kenney
AMVER Maritime Relations Officer
United States Coast Guard
Battery Park Building
New York, NY 10004
Tel: 212-668-7764
Fax: 212-668-7684
Telex: 127594 AMVERNYK

Other Port Meteorological Officers

Australia

Headquarters
Tony Baxter
Bureau of Meteorology
150 Lonsdale Street, 7th Floor
Melbourne, VIC 3000
Tel: +613 96694651
Fax: +613 96694168

Melbourne
Michael T. Hills, PMA
Victoria Regional Office
Bureau of Meteorology, 26th Floor
150 Lonsdale Street
Melbourne, VIC 3000
Tel: +613 66694982
Fax: +613 96632059

Fremantle
Captain Alan H. Pickles, PMA
WA Regional Office
1100 Hay Street, 5th Floor
West Perth WA 6005
Tel: +619 3356670
Fax: +619 2632297

Sydney
Captain E.E. (Taffy) Rowlands, PMA
NSW Regional Office
Bureau of Meteorology, Level 15
300 Elizabeth Street
Sydney NSW 2000
Tel:+612 92961547
Fax: +612 92961589
Telex: AA24640

Canada

Randy Sheppard, PMO
Environment Canada
1496 Bedford Highway, Bedford
(Halifax) Nova Scotia B4A 1E5
902-426-6703

Denis Blanchard
Environment Canada
100 Alexis Nihon Blvd., 3rd Floor
Ville St. Laurent, (Montreal) Quebec
H4M 2N6
Tel: 514-283-6325

D. Miller, PMO
Environment Canada
Bldg. 303, Pleasantville
P.O. Box 21130, Postal Station "B"
St. John's, Newfoundland A1A 5B2
Tel: 709-772-4798

Bob McArter, PMO
Environment Canada
700-1200 W. 73rd Avenue
Vancouver, British Columbia V696H9
Tel: 604-664-9136

Ron Fordyce, Supt. Marine Data Unit
Rick Shukster, PMO
Environment Canada
Port Meteorological Office
100 East Port Blvd.
Hamilton, Ontario L8H 7S4
Tel: 905-312-0900
Fax: 905-312-0730

China

YU Zhaoguo
Shanghai Meteorological Bureau
166 Puxi Road
Shanghai, China

Continued on Page 96

Meteorological Services

Continued from Page 95

Denmark

Commander Lutz O. R. Niegsch
PMO, Danish Meteorological Inst.
Lyngbyvej 100, DK-2100
Copenhagen, Denmark
Tel: +45 39157500
Fax: +45 39157300

United Kingdom

Headquarters
Capt. Stuart M. Norwell,
Marine Superintendent, BD (OM)
Meteorological Office, Met O (OM)
Scott Building, Eastern Road
Bracknell, Berks RG12 2PW
Tel: +44-1344 855654
Fax: +44-1344 855921
Telex: 849801 WEABKA G

Bristol Channel
Captain Austin P. Maytham, PMO
P.O. Box 278, Companies House
CrownWay, Cardiff CF4 3UZ
Tel: + 44 1222 221423
Fax: +44 1222 225295

East England
Captain John Steel, PMO
Customs Bldg., Albert Dock
Hull HU1 2DP
Tel: +44 1482 320158
Fax: +44 1482 328957

Northeast England
Captain Gordon Young, PMO
Able House, Billingham Reach
Industrial Estate, Cleveland TS23 lPX
Tel: +44 1642 560993
Fax:+44 1642 562170

Northwest England
Captain Jim Williamson, PMO
Room 313, Royal Liver Building
Liverpool L3 1JH
Tel:+44 151 2366565
Fax: +44 151 2274762

Scotland and Northern Ireland
Captain Peter J. Barratt, PMO
Navy Buildings, Eldon St.
Greenock, Strathclyde PA16 7SL
Tel: +44 1475 724700
Fax: +44 1475 892879

Southeast England
Captain Harry Gale, PMO
Trident House, 21 Berth, Tilbury Dock
Tilbury, Essex RM18 7HL
Tel: +44 1375 859970
Fax: +44 1375 859972

Southwest England
Captain Douglas R. McWhan, PMO
8 Viceroy House, Mountbatten Centre
Millbrook Rd. East
Southampton SO15 lHY
Tel: +44 1703 220632
Fax: +44 1703 337341

France

Yann Prigent, PMO
Station Mét., Noveau Semaphore
Quai des Abeilles, Le Havre
Tel: +33 35422106
Fax: +33 35413119

P. Coulon
Station Météorologique
de Marseille-Port
12 rue Sainte Cassien
13002 Marseille
Tel: +33 91914651 Ext. 336

Germany

Henning Hesse, PMO
Wetterwarte, An der neuen Schleuse
Bremerhaven
Tel: +49 47172220
Fax: +49 47176647

Jurgen Guhne, PMO
Deutscher Wetterdienst
Seewetteramt
Bernhard Nocht-Strasse 76
20359 Hamburg
Tel: 040 3190 8826

Greece

George E. Kassimidis, PMO
Port Office, Piraeus
Tel: +301 921116
Fax: +3019628952

Hong Kong

H. Y. Chiu, PMO
Royal Observ. Ocean Centre Office
Room 1454, Straight Block
14/F Ocean Centre, 5
Canton Road Tsim Sha Tsui,
Kowloon, Hong Kong
Tel: +852 29263113
Fax: +852 23757555

Israel

Hani Arbel, PMO
Haifa Port
Tel: 972 4 8664427

Aharon Ofir, PMO
Marine Department
Ashdod Port
Tel: 972 8 8524956

Japan

Headquarters
Marine Met. Div., Marine Dept.
Japan Meteorological Agency
1-34 Otemachi, Chiyoda-ku
Tokyo, 100 Japan
Fax: 03-3211-6908

Port Meteorological Officer
Kobe Marine Observatory
14-1, Nakayamatedori-7-chome
Chuo-ku, Kobe, 650 Japan
Fax: 078-361-4472

Port Meteorological Officer
Nagoya Local Meteorological Obs.
2-18, Hiyori-cho, Chikusa-ku
Nagoya, 464 Japan
Fax: 052-762-1242

Port Meteorological Officer
Yokohama Local Met. Observatory
99 Yamate-cho, Naka-ku,
Yokohama, 231 Japan
Fax: 045-622-3520

Kenya

Ali J. Mafimbo, PMO
PO Box 98512
Mombasa, Kenya
Tel: +254 1125685
Fax: +254 11433440

Malaysia

NG Kim Lai
Assistant Meteorological Officer
Malaysian Meteorological Service

Continued on Page 97

Meteorological Services

Continued from Page 96

Jalan Sultan, 46667 Petaling
Selangor, Malaysia

Mauritius

Mr. S Ragoonaden
Meteorological Services
St. Paul Road, Vacoas, Mauritius
Tel: +230 6861031
Fax: +230 6861033

Netherlands

John W. Schaap, PMO
KNMI/PMO-Office
Wilhelminalaan 10, PO Box 201
3730 AE De Bilt, Netherlands
Tel: +3130 2206391
Fax: +3130 210849
E-Mail: schaap@knmi.nl

New Zealand

Julie Fletcher, MMO
Met. Service of New Zealand Ltd.
Tahi Rd., PO Box 1515
Paraparaumu Beach 6450
New Zealand
Tel: +644 2973237
Fax: +644 2973568

Norway

Tor Inge Mathiesen, PMO
Norwegian Meteorological Institute
Allegaten 70, N-5007
Bergen, Norway
Tel: +475 55236600
Fax: +475 55236703

Poland

Jozef Kowalewski,PMO
Institute of Meteorology and Water Mgt.
Maritime Branch
ul.Waszyngtona 42, 81-342 Gdynia
Poland
Tel: +4858 6205221
Fax: +4858 6207101
E-mail: kowalews@stratus/imgw.gdynia.pl

Saudi Arabia

Mahmud Rajkhan, PMO
National Met. Environment Centre
Eddah
Tel:+ 9662 6834444 Ext. 325

Singapore

Edmund Lee Mun San, PMO
Meteorological Service, PO Box 8
Singapore Changi Airport
Singapore 9181
Tel: +65 5457198
Fax: +65 5457192

South Africa

C. Sydney Marais, PMO
c/o Weather Office
Capt Town International Airport 7525
Tel: + 27219340450 Ext. 213
Fax: +27219343296

Gus McKay, PMO
Meteorological Office
Durban International Airpot 4029
Tel: +2731422960
Fax: +2731426830

Sweden

Morgan Zinderland
SMHI
S-601 76 Norrköping, Sweden

Meteorological Services - Forecasts

Headquarters

Laura Cook
Marine Weather Services Program Manager
National Weather Service
1325 East-West Highway, Room 14126
Silver Spring, MD 20910
Tel: 301-713-1677 x. 126
Fax: 301-713-1598

U.S. NWS Offices

Atlantic & Eastern Pacific Offshore & High Seas

David Feit
National Centers for Environmental Prediction
Marine Prediction Center
Washington, DC 20233
Tel: 301-763-8442
Fax: 301-763-8085

Tropics

Andrew Shashy
National Centers for Environmental Prediction
Tropical Prediction Center
11691 Southwest 17th Street
Miami, FL 33165
Tel: 305-229-4470
Fax: 305-553-1264

Central Pacific High Seas

Hans Rosendal
National Weather Service Forecast Office
2525 Correa Road, Suite 250
Honolulu, HI 96822-2219
Tel: 808-973-5280
Fax: 808-973-5281

Alaska High Seas

Dave Percy
National Weather Service
6930 Sand Lake Road
Anchorage, AK 99502-1845
Tel: 907-266-5106
Fax: 907-266-5188

Coastal Atlantic

Robert Marine
National Weather Service Forecast Office
P.O. Box 1208
Gray, ME 04039
Tel: 207-688-3216

Tom Fair
National Weather Service Forecast Office
445 Myles Standish Blvd.
Taunton, MA 02780
Tel: 508-823-1900

Continued on Page 98

Meteorological Services
Continued from Page 97

Ingrid Amberger
National Weather Service Forecast Office
175 Brookhaven Avenue
Building NWS #1
Upton, NY 11973
Tel: 516-924-0499 (0227)

James A. Eberwine
National Weather Service Forecast Office
Philadelphia
732 Woodlane Road
Mount Holly, NJ 08060
Tel: 609-261-6600 ext. 238

Dewey Walston
National Weather Service Forecast Office
44087 Weather Service Road
Sterling, VA 20166
Tel: 703-260-0107

Neil Stuart
National Weather Service Office
10009 General Mahone Hwy.
Wakefield, VA 23888-2742
Tel: 804-899-4200 ext. 231

John Elardo
National Weather Service Office
53 Roberts Road
Newport, NC 28570
Tel: 919-223-5737

Rick Neuherz
National Weather Service Forecast Office
1005 Capability Drive, Suite 300
Raleigh, NC 27606
Tel: 919-515-8209

Bruce Cherry
National Weather Service Forecast Office
2909 Aviation Way
West Columbia, SC 29170-2102
Tel: 803-822-8133

John F. Townsend
National Weather Service Office
5777 South Aviation Avenue
Charleston, SC 29406-6162
Tel: 803-744-0303 ext. 6 (forecaster)
803-744-0303 ext. 2 (marine weather recording)

Michael O'Brien
National Weather Service Forecast Office
11691 Southwest 17 Street
Miami, FL 33165-2149
Tel: 305-229-4525

Great Lakes

Daron Boyce, Senior Marine Forecaster
National Weather Service Forecast Office
Hopkins International Airport
Cleveland, OH 44135
Tel: 216-265-2370
Fax: 216-265-2371

Tom Paone
National Weather Service Forecast Office
587 Aero Drive
Buffalo, NY 14225
Tel: 716-565-0204 (M-F 7am-5pm)

Tracy Packingham
National Weather Service Office
5027 Miller Trunk Hwy.
Duluth, MN 55811-1442
Tel: 218-729-0651

Dave Guenther
National Weather Service Office
112 Airport Drive S.
Negaunee, MI 49866
Tel: 906-475-5782

Jim Skowronski and Jill Last
National Weather Service Office
2485 S. Pointe Road
Green Bay, WI 54313-5522
Tel: 414-494-5845

Thomas Zajdel
National Weather Service Forecast Office
Milwaukee
N3533 Hardscrabble Road
Dousman, WI 53118-9409
Tel: 414-297-3243
Fax: 414-965-4296

Dennis Haller
National Weather Service Forecast Office
333 West University Drive
Romeoville, IL 60446
Tel: 815-834-0673

Peter Chan
National Weather Service Office
4899 S. Complex Drive, S.E.
Grand Rapids, MI 49512-4034
Tel: 616-956-7180 or 949-0643

Scott Rozanski
National Weather Service Office
8800 Passenheim Hill Road
Gaylord, MI 49735-9454
Tel: 517-731-3384

Bill Hosman
National Weather Service Forecast Office
9200 White Lake Road
White Lake, MI 48386-1126
Tel: 248-625-3309
Fax: 248-625-4834

Coastal Gulf of Mexico

Constantine Pashos
National Weather Service Forecast Office
2090 Airport Road
New Braunfels, TX 78130
Tel: 210-606-3600

Len Bucklin
National Weather Service Forecast Office
62300 Airport Road
Slidell, LA 70460-5243
Tel: 504-522-7330

Steve Pfaff, Marine Focal Point
National Weather Service Forecast Office
300 Pinson Drive
Corpus Christi, TX 78406
Tel: 512-289-0959
Fax: 512-289-7823

Jim Bafnall
National Weather Service Office
500 Airport Blvd., #115
Lake Charles, LA 70607
Tel: 318-477-3422
Fax: 318-474-8705

Eric Esbensen
National Weather Service Office
8400 Airport Blvd., Building 11
Mobile, AL 36608
Tel: 334-633-6443
Fax: 334-607-9773

Paul Yura/Mark Jackson
National Weather Service Office
20 South Vermillion
Brownsville, TX 78521

Robert Van Hoven
National Weather Service Office
Houston
1620 Gill Road
Dickenson, TX 77539
Tel: 281-337-5074
Fax: 281-337-3798

Continued on Page 99

Meteorological Services

Continued from Page 98

Greg Mollere, Marine Focal Point
National Weather Service Forecast Office
3300 Capital Circle SW, Suite 227
Tallahassee, FL 32310
Tel: 904-942-8999
Fax: 904-942-9396

Dan Sobien
National Weather Service Office
Tampa Bay
2525 14th Avenue SE
Ruskin, FL 33570
Tel: 813-645-2323
Fax: 813-641-2619

National Weather Service Forecast Office
San Juan
Tel: 809-253-4586

Coastal Pacific

William D. Burton
National Weather Service Forecast Office
Bin C15700
7600 Sand Point Way NE
Seattle, WA 98115
Tel: 206-526-6095 ext. 231
Fax: 206-526-6094

Stephen R. Starmer
National Weather Service Forecast Office
5241 NE 122nd Avenue
Portland, OR 97230-1089
Tel: 503-326 2340 ext. 231
Fax: 503-326-2598

National Weather Service Office
4003 Cirrus Drive
Medford, OR 97504
Tel: 503-776-4303
Fax: 503-776-4344

Bill Forwood
National Weather Service Office
300 Startare Drive
Eureka, CA 95501
Tel: 707-443-5610
Fax: 707-443-6195

Jeff Kopps
National Weather Service Forecast Office
21 Grace Hopper Avenue, Stop 5
Monterey, CA 93943-5505
Tel: 408-656-1717
Fax: 408-656-1747

John Henderson
National Weather Service Forecast Office
520 North Elevar Street
Oxnard, CA 93030
Tel: 805-988-6615
Fax: 805-988-6613

Mark Moede
National Weather Service Office
11440 West Bernardo Ct., Suite 230
San Diego, CA 92127-1643
Tel: 619-675-8700
Fax: 619-675-8712

Dave Hefner
National Weather Service Forecast Office
101 12th Avenue, #21
Fairbanks, AK 99701-6266
Tel: 907-456-0247
Fax: 907-456-0381

Robert Kanan
National Weather Service Forecast Office
9109 Mendenhall Mall Road, Suite 3
Juneau, AK 99803-2179
Tel: 907-586-7493
Fax: 907-586-7122

Guam
Tel: 011-671-632-1010⚓

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
1315 East-West Highway
Distribution Unit
Silver Spring, MD 20910
Attn: Mariners Weather Log

40

Address Correction Requested
OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

Book Rate

In this Issue: